
Proceedings of Geoscience Colloquium

Geoscience Laboratory, Geological Survey of Pakistan
Islamabad

Volume 11 Special Issue
September, 1995

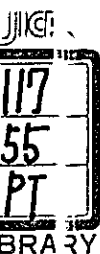
Research and Development Studies on Fused Magnesium Phosphate (FMP) Fertilizer

Special Issue Editors
Tahir Karim
Jiro Hirayama



Geoscience Laboratory Project
Technical Cooperation between
Geological Survey of Pakistan and
Japan International Cooperation Agency

Proceedings of Geoscience Colloquium: Volume 11/Special Issue (September, 1995)



**Proceedings of Geoscience Colloquium
Geoscience Laboratory
Geological Survey of Pakistan
Volume 11 (Special Issue)**

September 19, 1995

Copyright 1995 by the Geoscience Laboratory Project

Opinions expressed in this report are those of the authors and do not necessarily reflect the official views of either the Government of Pakistan or the Government of Japan
The responsibility for the authenticity of the data presented in this report rests with the author(s).

Geoscience Laboratory Project
Technical Cooperation Project between
Geological Survey of Pakistan (GSP) and
Japan International Cooperation Agency (JICA)

Project Director: *S.Hasan Gauhar (GSP)*
Chief Advisor: *Yoshiya Ikeda (JICA)*

Geoscience Laboratory, Geological Survey of Pakistan
Shahzad Town, P.O.Box 1461, Islamabad, Pakistan
Tel: +92-51-240423 Fax: +92-51-240223 E-mail pd%geolab@sdnpk.undp.org.pk

Special Issue Editors
Chief Editor: *Tahir Karim (Deputy Director, GSP)*
Editor: *Jiro Hiruyama (JICA Expert)*

CONTENTS

Editors' Note	1
<i>Hirayama, J., Tahir Karim, Okamura, N., Hada, S. and Sato, M.</i>	3
A Geological Study and Some Feasibility Considerations for the Production of Fused Magnesium Fertilizer (FMP) in Pakistan	149
<i>Naka, T., Hirayama, J. and Tahir Karim</i>	
Phosphorite-bearing Cambrian Formations in the Himalayan Fold and Thrust Belt, Hazara Division, Northern Pakistan	181
<i>Tahir Karim</i>	
Preliminary Results of Study on Genesis of Kumhar Magnesite, Hazar, Pakistan	
Appendix. Geologic Map of Abbottabad Area, Northern Pakistan	

**Proceedings of Geoscience Colloquium
Geoscience Laboratory
Geological Survey of Pakistan
Volume 11 (Special Issue)**

September 19, 1995

Copyright 1995 by the Geoscience Laboratory Project

Opinions expressed in this report are those of the authors and do not necessarily reflect the official views of either the Government of Pakistan or the Government of Japan. The responsibility for the authenticity of the data presented in this report rests with the author(s).

**Geoscience Laboratory Project
Technical Cooperation Project between
Geological Survey of Pakistan (GSP) and
Japan International Cooperation Agency (JICA)**

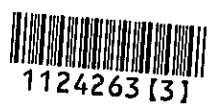
**Project Director: *S.Hasan Gauhar (GSP)*
Chief Advisor: *Yoshiya Ikeda (JICA)***

**Geoscience Laboratory, Geological Survey of Pakistan
Shahzad Town, P.O.Box-1461, Islamabad, Pakistan
Tel: +92-51-240423 Fax: +92-51-240223 E-mail: pd%geolab@sdnpk.undp.org.pk**

**Special Issue Editors
Chief Editor: *Tahir Karim (Deputy Director, GSP)*
Editor: *Jiro Hirayama (JICA Expert)***

CONTENTS

Editors' Note	1
<i>Hirayama, J., Tahir Karim, Okamura, N., Hada, S. and Sato, M</i>	3
A Geological Study and Some Feasibility Considerations for the Production of Fused Magnesium Fertilizer (FMP) in Pakistan	149
<i>Naka, T., Hirayama, J. and Tahir Karim</i>	
Phosphorite-bearing Cambrian Formations in the Himalayan Fold and Thrust Belt, Hazara Division, Northern Pakistan	181
<i>Tahir Karim</i>	
Preliminary Results of Study on Genesis of Kumhar Magnesite, Hazar, Pakistan.	
Appendix: Geologic Map of Abbottabad Area, Northern Pakistan	



1124263 [3]

EDITORS' NOTE

The rock phosphate and magnesite deposits of Hazara area have been re-evaluated with a view to assess their suitability as the basic raw materials for the possible industrial production of a fertilizer called Fused Magnesium Phosphate (FMP). This fertilizer, although in use in Japan and some other Far Eastern countries for the last few decades, has not yet been tested and applied in Pakistan.

The research work undertaken in the GSP's Geoscience Laboratory during 1993-95 in collaboration with JICA experts has produced encouraging results. The most satisfying aspect of this research has been that, if found economically feasible after further detailed studies, the local production of FMP will consume the hitherto unutilized low grade phosphate (less than 20% P_2O_5) and the underutilized large reserves of magnesite together with small quantities of quartz/quartzite which is also abundantly available in the region.

This special volume of the Proceedings of the Geoscience Colloquium contains the results of all the geological and some techno-economic studies conducted so far in the GeoLab and in Japan through JICA assistance. Its aim is to present interim results of the research to planners, potential investors, users and the decision-makers and to solicit their opinion and suggestions with regard to future direction of research which may eventually lead to the use of these low-value items for producing a rather high-value product.

Tahir Karim
&
Jiro Hirayama
Editors

Acknowledgement

The editors are indebted to all the organizations and individuals who have helped in preparation of this report by providing published and unpublished reports and maps or by exchange of information through technical discussions. We are specially thankful to the following officials for their all out help and guidance in obtaining relevant information.

Mr. Tajammal Hussain, Chief, Industries, Commerce and Minerals, Planning & Development Division, Government of Pakistan, Islamabad.

Mr. M. Nawaz Khan, Director General (Minerals), Ministry of Petroleum & Natural Resources, Islamabad.

Mr. Mirza Saeed Hasan, Deputy Secretary, Ministry of Petroleum & Natural Resources, Islamabad.

Dr. Sharief Zia, National Agricultural Research Council, Islamabad.

Chaudhry M. Saeed, FECTO Cement Factory, Sangjani, Islamabad.

Chaudhry M. Rashid, General Manager, Mustehqam Cement, Hattar.

Mr. Gulraz Khan, Secretary, Industries, Government of NWFP, Peshawar.

Mr. M. Abid Khan, (Then Director Minerals), SDA, Peshawar.

Mr. Behrawar Khan, Managing Director, Kakul Phosphate Mine, Sarhad Development Authority, Abbottabad.

Mr. Walid Khan, General Manager (Minerals), Sarhad Development Authority, Peshawar.

Mr. Nisar Khan, Senior Geologist, Kakul Phosphate Mine, Abbottabad.

Mr. Ayaz Mahmood, Geologist, Pakistan Industrial Development Corporation, Magnesite Mine, Kumhar, Abbottabad.

Mr. Rashid Ali Khan, General Manager, Nowshera Sheet Glass, Shaidu.

Chaudhry M. Chughtai, Production Manager, Hazara Fertilizer, Haripur.

Dr. Ghulam Saeed, Director General, Soil Survey of Pakistan, Lahore.

Dr. Iqbal Bajwa, General Manager (Technical), National Fertilizer Marketing Limited, Lahore.

Mr. Ahmad Tariq Faruqi, Director, EMCO Tiles, Lahore.

Dr. Nisar Ahmad, Project Director, National Development Fertilizer Corporation, Islamabad.

100

A Geological Study and Some Feasibility Considerations for the Production of Fused Magnesium Fertilizer (FMP) in Pakistan

Jiro Hirayama*, Tahir Karim**, Naoki Okamura***, Susumu Hada***,
and Masuo Sato***

* JICA expert, Geoscience Laboratory Project, Islamabad

** Geoscience Laboratory, Geological Survey of Pakistan, Islamabad

*** JICA expert, Tohsoh Co., 1-1-7 Akasaka, Minato-ku, Tokyo, 107, Japan

Abstract

Fused magnesium phosphate (FMP) is a phosphatic fertilizer consisting of P_2O_5 , MgO, CaO, and SiO_2 . It is ordinarily produced by fusing and quenching a mixture of quality-ore of phosphate containing more than 30 % of P_2O_5 and serpentinite. Substituting serpentinite as the material by magnesite is considered to not only make the utilization of low-grade ore of phosphate in the Hazara area possible but also promote the exploitation of under-developed magnesite in the same area. To verify the idea, a JICA team consisting of a mining engineer, a manufacturing engineer, and a fertilizer and marketing specialist was invited to conduct an extensive survey on mining costs of raw materials, production costs and the marketability of FMP under a close cooperation with Geoscience Laboratory, Geological Survey of Pakistan between May 23 and June 12, 1994.

The conclusion of the study is that the manufacturing of FMP with 20% of P_2O_5 is feasible in Pakistan, if the following requirements are met, :

1. The effectiveness of FMP be verified through experiments for various crops to be conducted by competent authorities;
2. Infrastructures required for the project, including access roads to mining sites and power supply, be consolidated by the Pakistani authorities concerned;
3. The Pakistani governments, Federal and Provincial, actively participate in implementing this project to extend necessary supports;
4. Financial and technical assistance for operating this project be offered from external resources including JICA.

INTRODUCTION

Historical changes in local production and import supply of nitrogen and phosphatic fertilizers are shown in Figures 1 and 2, respectively, which are made on the basis of the statistics published by the National Fertilizer Development Center (NFDC, 1993). These figures show only the changes between 1957/58 Fiscal Year (F.Y.) marking the initiation of local production of nitrogen and phosphatic fertilizers and 1992/93 F.Y.

Imports of nitrogen fertilizers have increased from 10,820 tons in 1957/58 to 409,610 tons in 1992/93 with a considerable yearly fluctuation, whereas their local production has rapidly expanded from merely 1,460 tons to as much as 1,227,280 tons during the same period. As a result, the local production has predominated over the import supply since 1980/81, and become more than fourfold larger than the latter in 1992/93. (Figure 1).

Though 11,000 tons of phosphatic fertilizers were temporarily imported in 1957/58, their active import resumed in 1966/67 after a long interruption. Subsequently, it has grown from some 16,000 tons to as much as 390,000 tons in 1992/93. On the other hand, the production of single-superphosphate (SSP) started at the Faisalabad plant of the National Fertilizer Corporation (NFC) in 1957, and it has steadily grown from as little as 180 tons to 105,000 tons in 1992/93. Nevertheless, the import supply is nearly four times larger than the local production even in 1992/93 (Figure 2). Moreover, the raw materials for the local production, such as phosphorite ore and sulfur, have been mostly

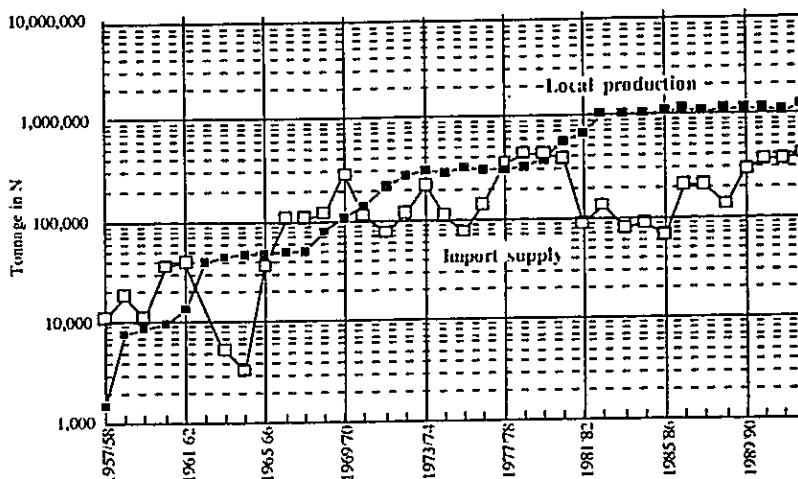


Figure 1. Historical change of local production and import supply of nitrogen fertilizers between 1957 and 1993.

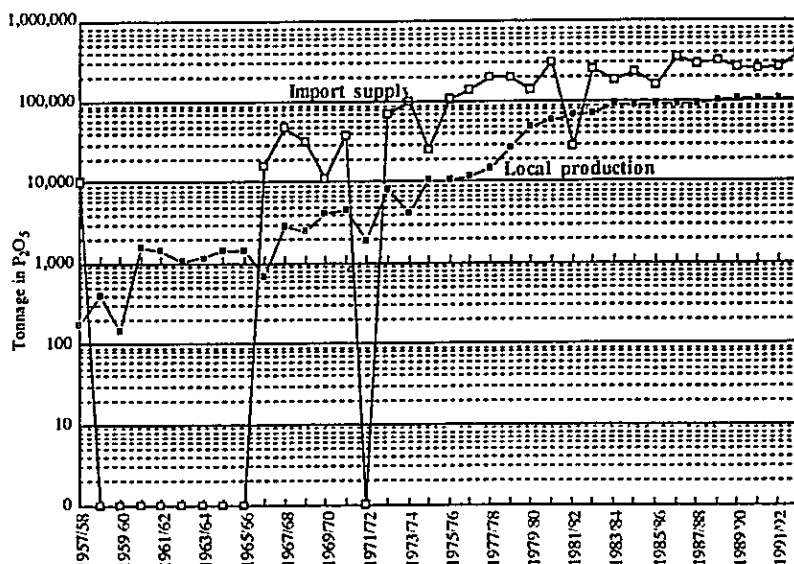


Figure 2 Historical change of local production and import supply of phosphatic fertilizers between 1957 and 1993

imported from abroad. The first plant to use local phosphorite ore was established by NFC at Haripur in 1989, and produces 16,000 nutrient tons of SSP in 1992/93 (NFDC, 1993). However, half of the phosphorite ore consumed at the Haripur plant is imported from abroad.

The Haripur plant has been annually supplied some 30,000 tons of phosphorite ore for the production of SSP from the Kakul mine, which is located about 50 km north of Haripur (Figure 3) and operated by the Sarhad Development Authority (SDA). The ore, which contains 27.7 % of P_2O_5 and 23.4 % of SiO_2 on average, is not necessarily excellent as the material for SSP. Further, the reserve is estimated to last for as short as 7 to 10 years at the present mining pace (Mononobe et al., 1992a).

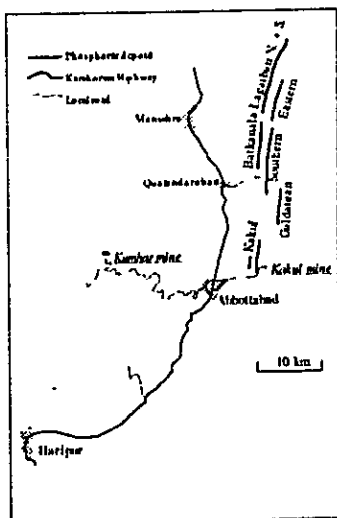


Figure 3. Distribution map of phosphorite and magnesite deposits in Hazara area

For 18 years ranging from 1976 to 1994, however, active exploratory works including detailed topographic and geologic mapping, core drilling, aditting, trenching, ore assaying have been carried out by SDA in the Galdanian-Tarnwai-Lagarban area north of the kakul mine, resulting in an estimation of the potential reserve exceeding 20 million tons and the recoverable reserve amounting to 7.5 million tons. Out of several phosphorite deposits traced in this area, the Eastern phosphorite deposit has been proven to have 2.5 million tons of total recoverable ore containing 28 % of P_2O_5 and 17 to 23.5 % of SiO_2 on average, which is confirmed by a plant test to be suitable for manufacturing SSP. Though a mining project to supply 60,000 tons / annum of phosphorite ore from the deposit to the Haripur SSP plant was proposed to the Federal Government in 1990, it has yet to be implemented except for a partial constriction of the access road

In order to break the deadlock, Hirayama and Mononobe (1992) proposed an idea to produce Fused Magnesium Phosphate (FMP) by fusing and quenching a mixture of low-grade phosphorite ore unsuitable for the production of SSP and magnesite ore that occurs in the nearby Kumhar mine but remains underdeveloped. The Tohsoh Co., a Japanese manufacturer of FMP, conducted successfully a production test of FMP by using phosphorite, magnesite, and quartzite ores collected from the Kakul and Kumhar mines in 1994.

Responding to the proposal, the Japan International Cooperation Agency (JICA) dispatched N. Okamura, a fertilizer and marketing expert, S. Hada, a manufacturing engineer, and S. Sato, a mining engineer, to study the feasibility of the idea for three weeks between May 23 and June 12, 1994.

Prior to the arrival of these short-term experts, Hirayama and Tahir Karim collected as much local information concerning agriculture, climate, soil, fertilizers, and geology and mining of the Kakul and Kumhar mines as possible according to their requests to make their short visit most effective. Further, Tahir Karim made appointments to visit many offices concerned, such as the Planning Division of the Pakistan Government, the NWFP Government, the National Agricultural Research Center, the Soil Survey of Pakistan, the Sarhad Development Authority, FECTO Cement Co. (Taxila), Mustekham Cement Ltd. (Hattar Industrial Park), Nowshera Sheet Glass Industries Ltd., EMCO Industries Ltd., General Ceramic Industries Ltd., the Haripur SSP plant of NFC, National Fertilizer Marketing Ltd., the Kakul and Kumhar mines operated by SDA and the Pakistan Industrial Development Corporation (PIDC) respectively.

Finally, Hirayama made detailed calculations of monthly accounts of production cost of raw materials and FMP on the basis of a final report of the feasibility study submitted to JICA by the three short-term experts (1994). A general information on FMP

introduced herein is based on two booklets published by the Fused Magnesium Phosphate Manufacturers' Association (1979, 1983).

MANUFACTURING METHOD OF FMP

FMP is usually manufactured by fusing a mixture of quality ore of phosphorite and magnesium-rich silicate rocks like serpentinite and quenching the resultant melt by water-jet. For melting the raw materials, an electric furnace or a fuel furnace is adopted as shown in Figure 4.

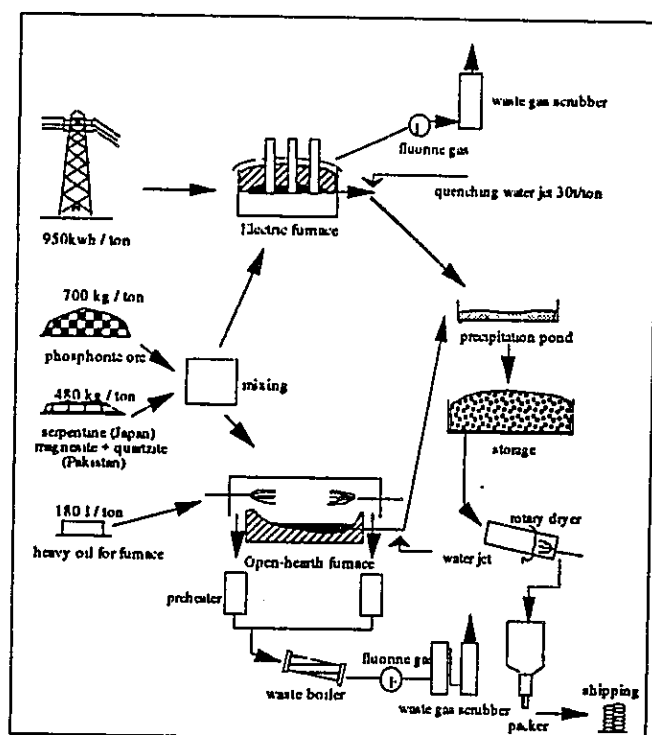


Figure 4. A flow of manufacturing process of fused magnesium phosphate (FMP).

Table 1. A guaranteed composition of nutrients in FMP

Nutrients	Standard contents	Range of contents
P_2O_5	20 %	18 ~ 25 %
MgO	15 %	13 ~ 18 %
CuO	30 %	28 ~ 35 %
SiO_2	20 %	18 ~ 24 %

In case of the electric method, a specially designed, semi-closed type of 2,000 to 10,000 Kw furnace is employed. Phosphorite and serpentinite charged in the furnace are easily smelted at 1,400°C. A small amount of fluorine gas is removed through a scrubber. The resultant melt is quenched by water jet to prevent it from forming insoluble crystals of apatite and forsterite by slow cooling. In case of fuel furnace, an open hearth furnace has been proven to be best fit for the production of FMP.

The essence of our production method consists in substituting serpentinite by magnesite ($MgCO_3$) that is abundant in the present area to make it possible to utilize low-grade phosphorite ores which remain unused. As FMP produced in Japan uses serpentinite that has much less ignition loss than magnesite as a material, quality ores of

phosphorite exceeding 32 percent in P_2O_5 are required to get a guaranteed composition of the final product as shown in Table I. As magnesite loses about 52 percent of the total weight as carbon dioxide by heating, FMP with the guaranteed nutrient composition can be obtained from low-grade phosphorite ore by substituting serpentinite by magnesite.

Another important advantage of FMP is less strict quality requirements for phosphate ores as compared with a variety of phosphatic fertilizers produced through phosphoric acid. For instance, SDA is imposed a penalty on the phosphorite ore exceeding 11 % in silica content by NFC. FMP that uses magnesite as a raw material, on the contrary, requires some addition of silica to raise the fluidity of the melt in the furnace.

In general, most phosphoric acid is produced by reacting phosphate rock with sulfuric acid and water. The reaction forms a sludge of gypsum and phosphoric acid. When the contents of MgO and R_2O_3 ($Fe_2O_3 + Al_2O_3$) exceed 1 % and 2.5 to 3.0 % respectively, the viscosity of the sludge is enhanced to lower the efficiency of separation between phosphoric acid and gypsum. These harmful ingredients for the production of phosphoric acid are rather welcome as major components of FMP. Therefore, we can get rid of anxiety about the dilution by dolomite ($CaCO_3 \cdot MgCO_3$) and siliceous dolomite, which form the hanging and foot walls and intercalation of the phosphorite beds, during the mining operation. The appropriate dilution of the dolomitic rocks is rather desirable for the manufacturing of FMP.

CHARACTERISTIC FEATURES OF FMP

As previously mentioned, FMP is produced through the fusion of phosphate ores and magnesium-rich rocks such as serpentinite and magnesite and the quenching of the melt, marked by the conversion of major components of the raw materials into plant nutrients.

FMP is greenish black in color and averages 0.2 to 1.5 mm across. Larger grains are dissolved more slowly in soil than finer ones. It has an amorphous structure as shown in Figure 5. The glassy material formed by quenching consists of PO_4 ions and short chains of silicate anions. Calcium and magnesium ions are weakly bonded to oxygen atoms.

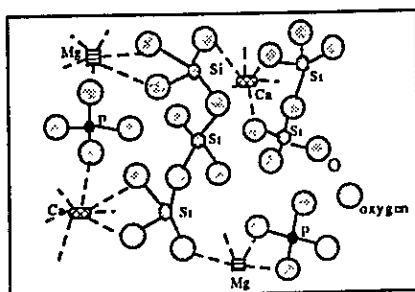


Figure 5. Amorphous structure of fused magnesium phosphate (FMP).

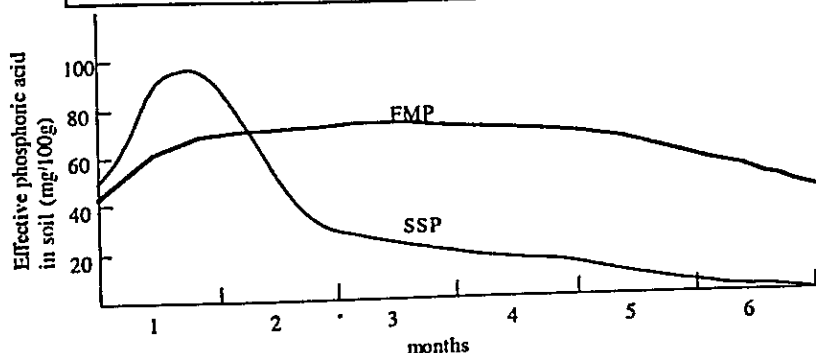


Figure 6. Monthly change in amount of effective PA remained in a unit soil after fertilization of FMP and SSP.

Consequently, FMP has the following characteristic features:

(1) The effectiveness of FMP is long-lasting and constant throughout the cultivation period of crops.

Because of the amorphous glassy texture, all nutrients of FMP is soluble not in ordinary water, but in a weak acid exclusively. Phosphoric acid (PA) in single superphosphate (SSP), which is highly water-soluble, is fixed by aluminum and iron ions in soil and rapidly loses the effectiveness after the fertilization, whereas FMP remains effective throughout the cultivation period of crops as shown in Figure 6.

(2) Weak acids in the soils prompt dissolution of all nutrients contained in FMP.

Table 2 shows an average of a number of solubility tests of FMP in a 2 % citric acid.

Table 2. Average solubility of nutrients of FMP in a citric acid (%)

Nutrients of FMP	P ₂ O ₅	CaO	MgO	SiO ₂
Solubility in 2 % citric acid	99.5 ~ 99	99 ~ 98	99 ~ 96	99 ~ 96

(3) Direct contact of FMP grains with soil particles and plant roots prompts dissolution and absorption of PA.

FMP is not only dissolved by weak acids in soils, but becomes soluble by a direct contact with soil particles and plant roots. The surface of soil colloids and plant roots are generally covered with a number of hydrogen ions. By dosing FMP rich in MgO and CaO, active ion-exchange starts between Ca⁺⁺ and Mg⁺⁺ of FMP and H⁺ on soil colloids and plant roots. Hydrogen ions are adsorbed onto FMP grains by the ion-exchange and destroy the glassy texture of FMP, giving rise to extrication of soluble PA and silica from FMP grains and prompting their absorption by plant roots. These processes are schematically shown in Figure 7.

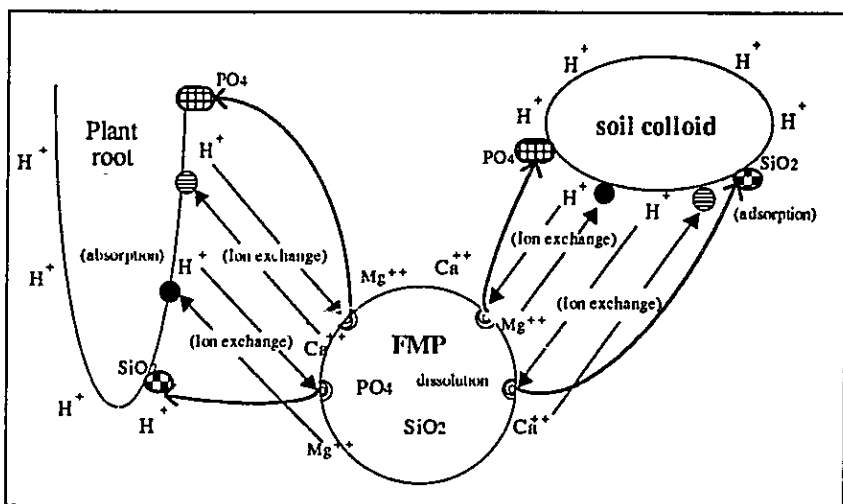


Figure 7. A scheme showing the dissolution and absorption of FMP by its direct contact with soil colloids and plant roots.

Table 3. Experimental results showing an enhanced solubility of FMP by a direct contact between plant roots and FMP.

	Treatment method	water + FMP	water + roots	water + FMP + roots
Case 1	Concentration of PA in the filtrate (mg/l)	4.6	0	12.2
	Treatment method	water + FMP	water + roots	water + FMP + roots
Case 2	Concentration of PA in the filtrate (mg/l)	5.5	0	9.9

Table 3 shows the results of two case studies to verify the enhancement of water solubility of FMP by its direct contact with young maize roots. In the case 1, the maize roots, from the surfaces of which base ions such as Ca^{++} and Mg^{++} are replaced by H^+ through an electrical dialysis in advance, are used. In the case 2, the maize roots, which undergo no electrical dialysis, are used. The dialyzed and unprocessed roots are put into two separate beakers containing water and FMP particles. After the two beakers are shaken for a given period, the concentrations of PA in the filtrates are measured. In each of the cases, the concentration of PA in the filtrate is higher than that of filtrates obtained from two other beakers, one of which contains only maize roots and water and the other only water and FMP particles. This indicates that the maize roots prompt the dissolution of PA of FMP into the water. Further, comparison between the two cases shows that the dialyzed roots covered with more hydrogen ions are more active in prompting the dissolution of FMP than the undialyzed roots with less hydrogen ions.

(4) Acid soils enhance the solubility of FMP.

Figure 8 shows that the addition of acid soils enhances the solubility and absorption of PA of FMP. However, an excessive addition of acid soils deteriorates the absorption by fixation of the nutrient by the soil. The absorption indices of PA on the vertical axis are the amounts of PA of FMP or SSP absorbed by wheat cultivated in beakers with different amounts of acid soil added, which are standardized by the amount of PA absorbed by wheat separately cultivated in two beakers, which are filled exclusively with quartz sand (130 g) and FMP or SSP containing 300 mg of P_2O_5 without addition of any acid soil. This figure shows that the more acid soil is added, the less water-soluble PA in SSP is absorbed by the crop as the acid is easily fixed by iron and aluminum in the soil.

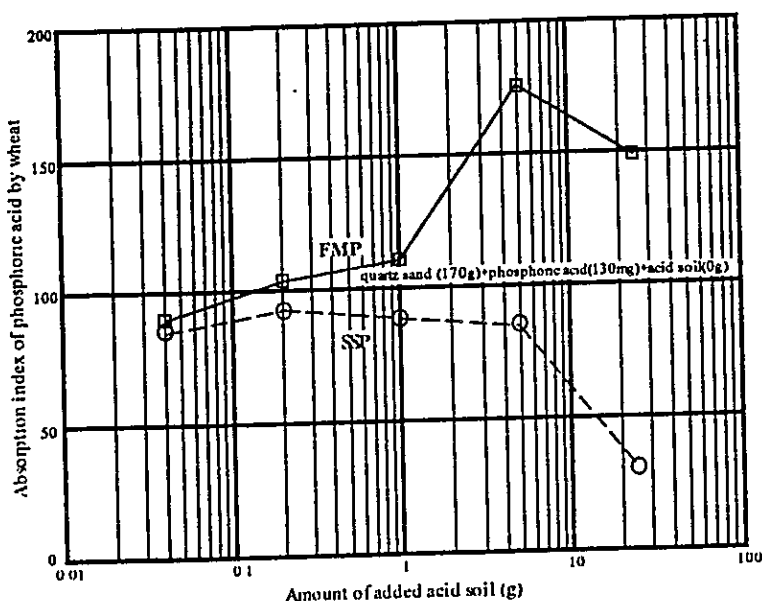


Figure 8. Relationship between absorption indices of PA and the amounts of added acid soil.

Table 4. Experimental results of the effects of a simultaneous application of KCl on the elution and absorption rates of FMP and SSP.

	Application of KCl with FMP	Elution rate of PA in a test-beaker		Absorption rate of PA by paddy cultivated in a test-pot	
		percentage	index	percentage	index
SSP	No	4.76	100	7.90	100
	Yes	6.04	127	15.6	128
FMP	No	3.88	100	4.30	100
	Yes	8.99	232	19.5	451

PA: phosphoric acid

(5) Co-existence of some bases increases the elution of FMP.

The elution rate of FMP is influenced by the other kind of fertilizer simultaneously applied. Table 4 displays the effect of a simultaneous application of KCl and FMP on the elution and absorption of SSP and FMP. Though the elution rate of SSP is a little larger than that of FMP without the simultaneous application the elution and absorption rates of FMP prove to be dramatically increased by the application of KCl compared with SSP.

(6) FMP is a comprehensive fertilizer which combines the properties of four kinds of fertilizers.

FMP is a very economical fertilizer which has the combined effectiveness of four separate fertilizers to enrich phosphorus, magnesium, calcium, and silica in soils. A 20-kg bag of FMP contains 4 kg of P_2O_5 , 3 kg of MgO, 9 kg of CaO, and 4 kg of SiO_2 , respectively. As shown in Figure 9, a 20-kg bag of FMP is equivalent in its nutrients to 1.2 bag of SSP, 0.6 bag of magnesium sulfate, 1.0 bag of calcium carbonate, and 0.7 bag of silica fertilizer.

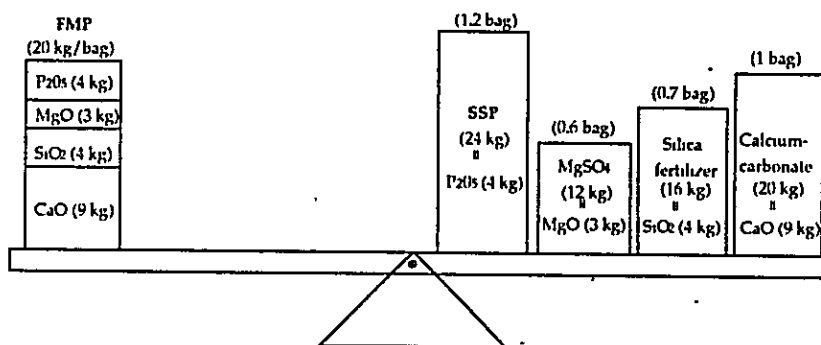


Figure 9. Economical advantage of FMP compared with the other fertilizers

EFFECTS OF THE CONSTITUENTS OF FMP

As previously stated, FMP is largely composed of phosphoric acid (PA), magnesia, lime, and silica. Effects of these major constituents on crops are as follows:

(1) Effects of phosphoric acid (PA)

PA plays an important role in forming nutrients stocked in crops, such as nucleoprotein, ficin, and lecithin. It has the following major effects on crops: (1) to quicken the maturation of crops; (2) to prompt the growth of roots and activate the germination of seeds; (3) to increase the number of offshoots, roots, stalks, and leaves of crops; (4) to increase the number and weight of seeds (Figure 10); and (5) to improve their quality (Figure 11).

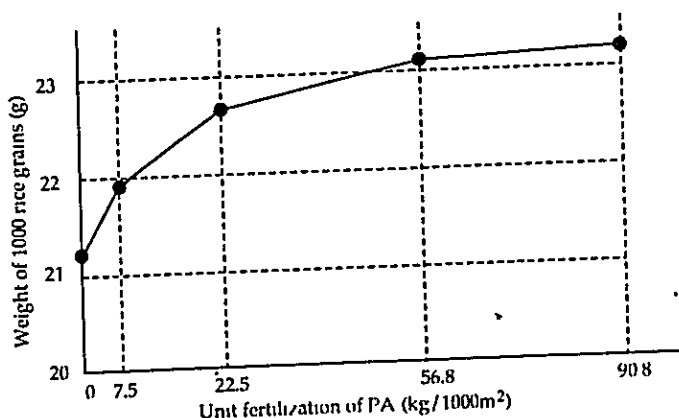


Figure 10. Relationship between the weight of 1000 of rice grains and an unit input of PA.

Furthermore, PA activates the growth of floating weeds and algae, which are responsible for nitrogen fixation and remain as nitrogen-rich humus in paddy fields. One kilogram of PA is proved to be equivalent to 170 kg of compost by a 16-year-long consecutive cultivation test of paddy under various conditions as shown in Figure 12.

Decomposition of paddy straws in soils requires activities of bacteria, which are known to be accelerated by dosage of nitrolime, PA, lime and magnesia.

Figure 13 exemplifies an increase in rice yield by a simultaneous utilization of these chemical fertilizers with fresh paddy straw and other organic matters

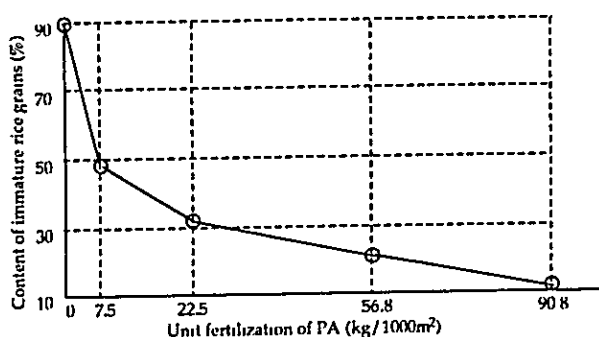


Figure 11. Relationship between an unit dosage of PA and the immature rice grain ratio.

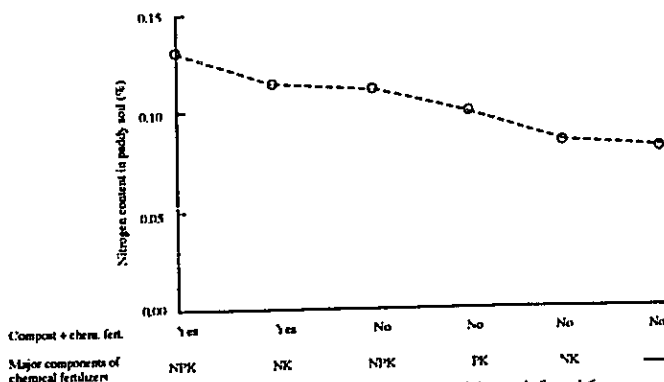


Figure 12. Nitrogen contents remaining in paddy soils cultivated for 16 years under different conditions.

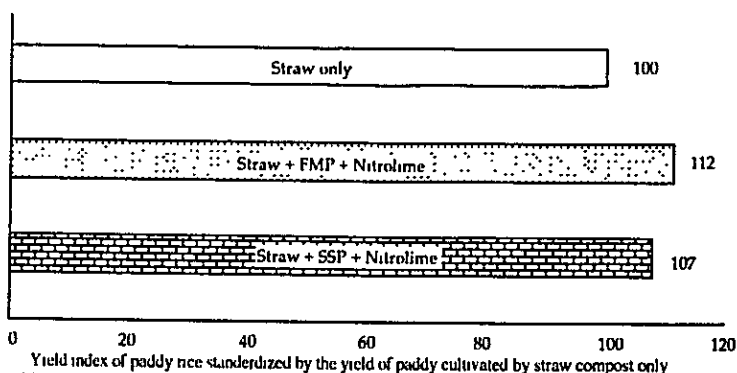


Figure 13. Acceleration of bacterial decomposition of paddy straw by mixing chemical fertilizers and the resultant increase of paddy yield.

Finally, PA improves the quality of pasture and promotes the increment of cattle weight. Figure 14 shows a comparison between a fertilized meadow and an unfertilized one.

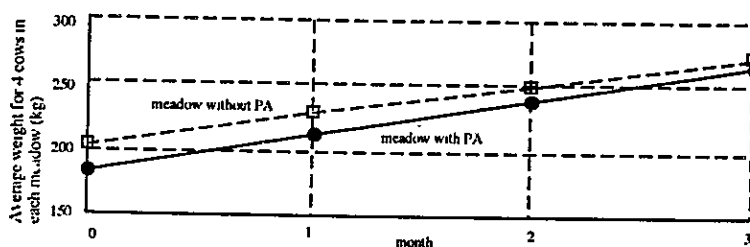


Figure 14. A comparison of weight increase of cows between fertilized and unfertilized meadows.

(2) Effects of magnesia

Magnesia is so helpful for absorption and transport of phosphorus in plant bodies that it is called a carrier of phosphorus. When there is enough magnesia in soils, phosphorus absorbed from roots is carried well through stalks to seeds, improving the yield and quality of crops. Table 5 shows a example of an enhanced enrichment of phosphorus in the ears of barley cultivated in 2000 test-pots.

Table 5. An example showing an effect of magnesia on the enrichment of phosphorus in the ears of barley cultivated in 2000 test-pots.

	Yield (g)		Amount of absorbed PA (mg)		
	Stalk	Ear	Stalk	Ear	Total
NPK	17	13	56	63	119
NPK + Mg	18	35	8	138	146

N = Nitrogen, P = Phosphorus, K = Potash; PA = Phosphoric acid

Magnesia is a major constituent of chlorophyll in plant leaves, so that a magnesia deficiency causes yellows and immature withering of crops. Besides, It enhances the content of fat in seeds (Table 6). In magnesia-deficient soils, however, an overdose of PA inflicts a reverse effect on the yield of crops (Figure 15)

Table 6. Relationship between the amount of magnesia fertilizer and the oil content of rapeseed.

	Yield of seed (kg)	Yield index	Oil content (%)
SSP	107.6	100	41.5
SSP + MgO	137.6	128	45.5

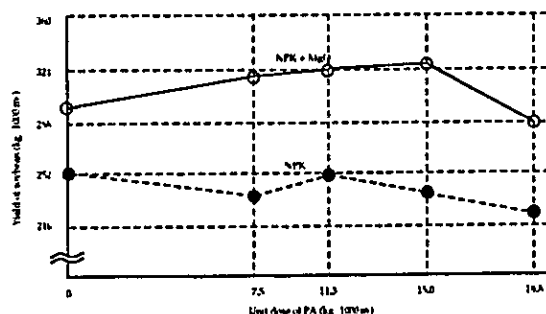


Figure 15. A proper dose of phosphorus fertilizer for soybean and an effect of additive magnesia on the yield (N = 9.4 kg, K₂O = 5.6 kg, MgO = 18.8 kg are used per 1000 m² respectively).

(3) Effects of silica

Bleeding sap which spills out of a cut end at the basal part of a paddy stalk contains tens to a hundred times more silica than paddy water. Figure 16 shows a comparison between the silica contents in bleeding sap obtained from aquicultural paddy and those of aquicultural liquid. It demonstrates that the ability of paddy to absorb silica is high enough to be called a representative of siliceous crops.

Figure 17 indicates paddy absorbs much more silica than the other nutrients out of the farm soil. For instance, it absorbs nearly ten times more silica than nitrogen. As some 30 kg of silica is absorbed to produce 150 kg of rice, a 600-kg yield per 1000 m² requires the absorption of about 120 kg of silica. If half of it is derived from irrigation water, soil, and compost, a supplementary dosage of some 60 kg of silica per 1000 m² would be required.

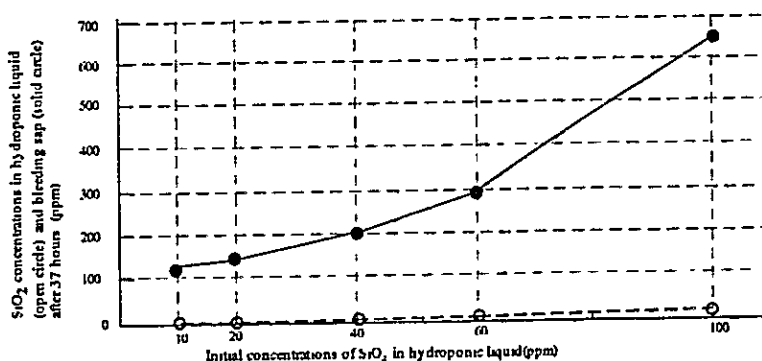


Figure 16. A comparison of SiO₂ concentrations in bleeding saps of paddy with those in hydroponic liquids 37 hours after the commencement of test cultivation.

Sufficient supply of silica greatly enhances not only the yield of paddy rice (Figure 18) but also resistance against diseases infecting paddy (Figure 19). Furthermore, silica helps paddy leaves erect and increase their exposure to sun light, strengthens paddy stalks not to be lodged by strong wind, and finally prevents a harmful over-dosage of nitrogen by enhancing the proper dosage (Figure 20).

(4) Effects of lime

It is said that tuffaceous soils associated with a high precipitation generally tend to become acidic. Firstly, it is caused by an excessive utilization of acid fertilizers that are combined with calcium in the soils and leached away with rain-water. Secondly, it is

derived from active cultivation of vegetables that consume more bases such as calcium and magnesium than ordinary grains (Figure 21). Thirdly, it is originated by their natural leaching out of soils by rain water.

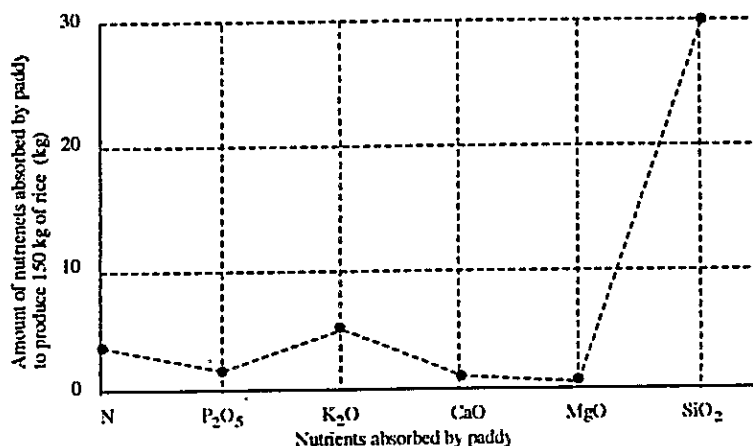
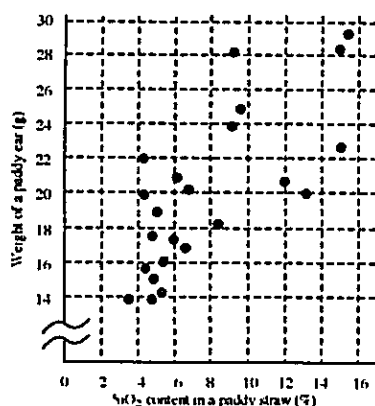


Figure 17. A comparison of the amounts of various nutrients absorbed by paddy to produce 150 kg of rice.



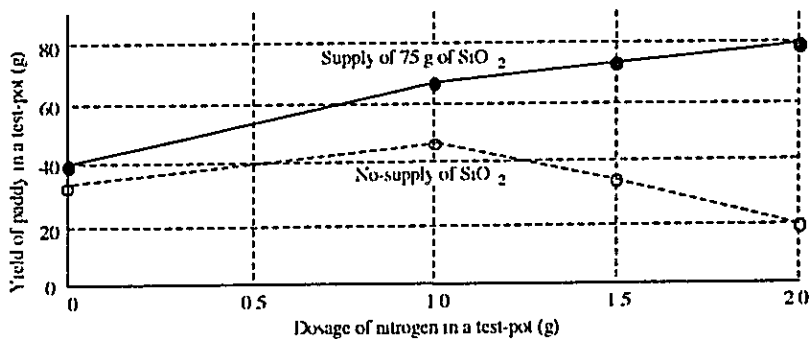


Figure 20. Enhancement of the proper dosage of nitrogen fertilizer and improvement of the paddy yield.

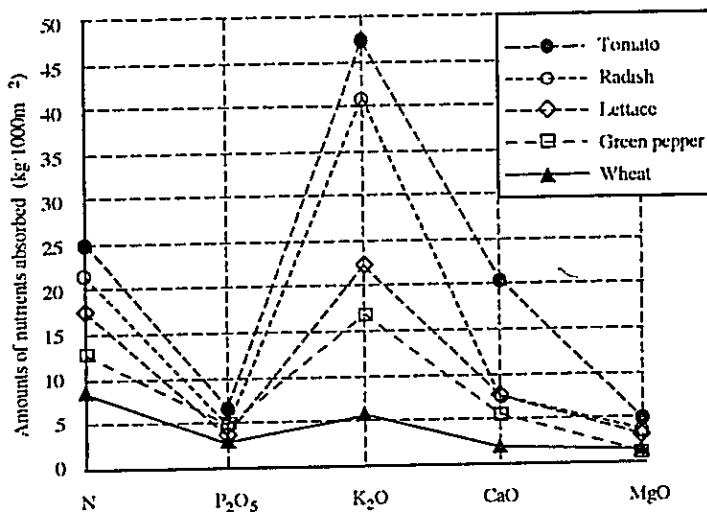


Figure 21 A comparison of amounts of absorbed nutrients between vegetables and wheat.

Acid soils inflict various harmful effects such as withering of sprouts, incomplete development of roots, and various diseases on vegetables and fruits, resulting in poor harvest.

Thus, lime not just helps neutralize acid soils, but also facilitates multiplication of plant cells, production of chlorophyll, transport of carbohydrates, growth of roots, strengthening resistance against diseases, and reduction of harmful effects by heavy metals. As calcium in FMP is well absorbed by crops, FMP plays an important role as its supplier.

ESTIMATION OF MINING COSTS OF RAW MATERIALS FOR FMP

Phosphorite, magnesite, and quartzite are required as raw materials for the local production of FMP. Large phosphorite deposits are distributed to the north of the Kakul mine, whilst magnesite ore and quartzite are procurable around the Kumhar mine (Figure 3). The following is a brief estimation of the mining costs of these raw materials.

1. Prospecting and Reserve Estimates of Raw Materials

1-1. Phosphorite ore

Phosphorite deposits are sporadically traceable for more than 20 km from Gallian through Kakul, Galdanian, Tarnwai, and Lagarban to Dalola (Figure 22). Though the deposits in this area were discovered in the late 1960s, it was not until 1975 that a plan for the systematic exploration and development was prepared by SDA. The phase-I of the exploration was initiated in January, 1976 with the technical assistance provided by the British Overseas Development Administration. Between 1976 and 1994, five phases of exploratory works were carried out in this area as shown in Table 7.

Though the Phase I and II were carried out under the technical cooperation with the British Government, the subsequent projects were conducted exclusively by SDA. As a result, the estimates of reserve increased year after year, amounting to some 20 million tons in total reserve and 7.3 million tons in total recoverable reserve at the end of the Phase IV (Tables 8 and 9). The average chemical compositions of the main deposits are shown in Table 10.

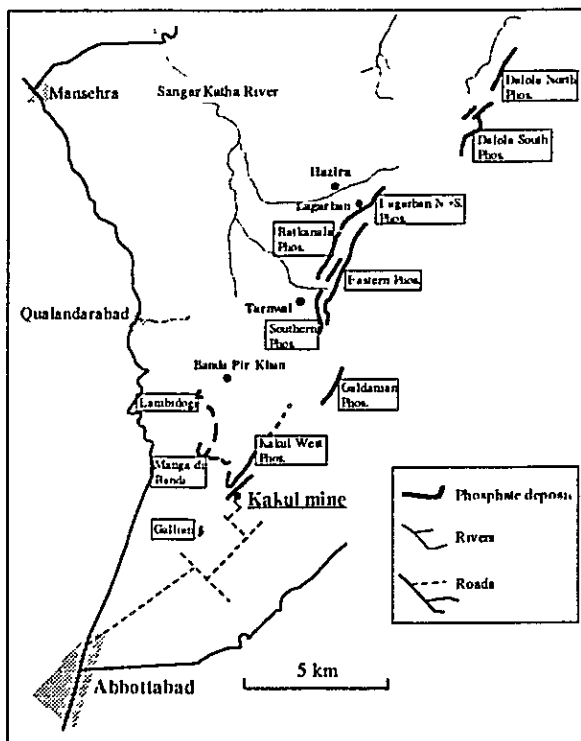


Figure 22. Distribution map of major phosphorite deposits in the Hazara area

Table 7. Exploration projects conducted by SDA between Phase I and Phase V.

	Phase I 76/1-77/6	Phase II 80/7-82/12	Phase III 83/1-86/6	Phase IV 86/7-91/6	Phase V 91/7-94/6	Total	Remarks
Drilling (m)	1,420	5,246	406	146	0	7,218	25 drill holes
Aditting (m)	1,312	4,566	2,600	2,885	168	11,531	37 adits
Number of trenches	68	124	48	31	10	281	
Topographic & geological mapping (ha)	120	500	61	88	0	769	1 500 1 5000
Number of assaying	4,940	12,716	4,902	5,346	0	27,904	
Cost (mill Rs.)	21 588	53 445	7,999	15,026	2 267	100 325	

Table 8. Total ore reserve at the end of the Phase IV.

	Measured reserve ^a	Indicated reserve ^{a,b}	Inferred reserve ^{a,b,c}	Total
Southern Ph	1 838	0 581	0 785	3 204
Lagarban N+S	1 496	0 847	0 234	2 577
Eastern Ph	2 385	0 837	1 353	4 575
Galdanai Ph	0 800	0 160	1 400	2 360
Batikanala Ph	0 700	1 263	2 726	4 689
Lamba Nakka	-	-	0 483	0 483
Mandorian	-	-	1 460	1 460
Total	7 219	3 688	8 441	19 348

(million tons)

- ^a **Measured reserve** It is defined as a reserve estimated by detailed sampling including drill holes, adits and trenches that can be considered to be sufficient to allow a reasonably accurate assessment of thickness and grade variations within the ore bodies with an average thickness exceeding 1.5 m and a grade exceeding 22 % in P_2O_5 .
- ^b **Indicated reserve** It is defined as a reserve estimated by detailed sampling including drill holes, adits and trenches that is sufficient to suggest a reasonably continuous area of phosphorite with an average thickness exceeding 1.5 m and a grade greater than 22 % of P_2O_5 .
- ^c **Inferred reserve** It is defined as a reserve for which no detailed sampling is available but which forms a logical part of the main phosphorite deposits and probably exceeds 1.5 m thick on average and 22 % in P_2O_5 .

Table 9. Total recoverable ore reserve at the end of the Phase IV.

	Measured (M)	Indicated (In)	Mt (Mts.+0.75*In)	Recov (0.65*Mt)	Dilution (0.12*Recov)	Tot. Recov. (Rec.+Dil.)
Southern Ph	1 838	0 581	2 274	1 478	0 177	1 655
Lagarban N+S	1 496	0 847	2 131	1 383	0 166	1 552
Eastern Ph	2 385	0 837	3 013	1 958	0 235	2 193
Galdanai Ph	0 800	0 160	0 920	0 598	0 072	0 670
Batikanala Ph	0 700	1 263	1 647	1 071	0 128	1 199
Total	7 219	3 688	9 985	6 490	0 779	7 269

(million tons)

Table 10. Average chemical compositions of phosphorite ore from the main deposits (%).

	P_2O_5	SiO_2	CaO	MgO
Southern Ph	26.0	9.0	2.5	4.0-5.0
Lagarban N+S	25.5	12.0	5.0	4.0
Eastern Ph	28.0	17.2	3.5	1.0
Galdanai Ph	29.0	13.0	3.0	1.0
Batikanala Ph.	25.8	44.0	3.3	5.0

1-2. Magnesite Ore

The Kumhar mine is located about 13.5 km west-northwest of Abbottabad and operated by the Pakistan Industrial Development Corporation (PIDC) to monthly ship some 500 tons of magnesite ore to a clinker plant in Rawalpindi to produce stamp materials for fixing blast furnaces and cement kilns.

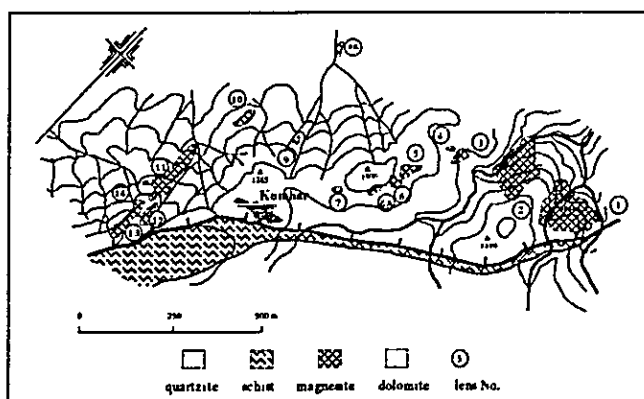


Figure 23. Distribution map of magnesite lenses in the Kumhar mine (modified from Mononobe et al., 1992b).

The mine area is underlain by dolomite, sericite schist, and quartzite in the Abbottabad Formation of Cambrian age. The magnesite deposits are developed in the dolomite, which is contacted with the underlying sericite schists by a E-W trending thrust fault. Fourteen lenses of magnesite have been confirmed for about 1,500 m from east to west. The general trend of the deposits changes from N-S in the western part to NE-WS in the central part to E-W in the eastern part (Figure 23).

A proved reserve of the Lenses I and II was estimated at some 3 million tons on the basis of an exploration by the Min-Koh International Consultants (1980), including a detailed geological mapping in a scale of 1: 2,000 and 7 adittings (Table 11). Subsequently, Mononobe et al. (1992) estimated the probable reserve of the Lenses 11 to 13 at 3.3 million tons.

Table 11. Ore reserves of the Lenses I and II estimated by Min-Koh International Consultants (1980).

	Possible reserve	Probable reserve	Proved reserve
Lens-I	5.21	3.37	1.84
Lens-II	3.54	2.40	1.14
Total	8.75	5.77	2.98

(million tons)

According to PIDC, 77 samples collected from the Lenses I and II range from 41.7 % to 47.6 % in MgO, averaging 46.6 %. The MgO contents of the Lens Nos. 11 to 13 are slightly lower than those of the Lenses I and II due to a higher content of CaO, ranging between 25.5 % and 47.4 %. A total of 61 samples collected from the Lenses 11 to 13 averages 45 % in MgO (Table 12).

Table 12. Average compositions of magnesite ores of 77 samples from the Lenses I and II and 61 samples from the Lenses Nos. 11 to 13

	Lenses I & II (%)	Lenses 11 to 13 (%)
MgO	46.6	45.0
CaO	0.96	2.25
Al ₂ O ₃	0.26	0.30
SiO ₂	0.89	0.45
Fe ₂ O ₃	0.54	0.75
Ignition loss	50.5	50.0

1-3. Quartzite Ore

For manufacturing FMP by substituting serpentinite by magnesite as a raw material, an addition of 40 to 60 kg of silica is required to increase the fluidity of the melt. A huge amount of quality ore of quartzite occurs around the Kumhar mine, the chemical composition is shown in Table 13.

Table 13. A chemical composition of a quartzite sample collected near the Kumhar mine.

SiO ₂	MgO	CaO	Al ₂ O ₃	Fe ₂ O ₃
93.8 %	0.5 %	0.01 %	4.8 %	0.9 %

2. Mine Planning and Production Cost of the Raw Materials

2-1. Phosphorite Ore

Taking into account an average thickness of 2.5 m and a steep inclination of 70° to 80° of the ore bodies and the competence of their host rocks, the shrinkage method of stoping with a dimension of 30 m long by 30 m wide is recommendable for the mining. The main entry point for mine development and subsequent operation will be suitable at the Tarnwai end of the deposit about 10 m above the riverbed of the Tarnwai River and the main haulage system is extended at the same level as the entry point in the foot wall of the deposits. The actual mining must be undertaken after the minable reserves guaranteeing at least two-year-long mining are confirmed. The basic principle of the prospecting is to extend levels to secure the confirmed reserve to counterbalance an annual output.

A natural ventilation system is basically applied to most of the levels and sublevels except for some working places which require a mechanical ventilation to remove blasting fumes and dust. Sublevels will be established at vertical intervals of 30 m throughout the

ore bodies and every third ones are connected to the surface as major levels to allow the entry to working places.

The ore gravitates down to the main haulage level and is loaded into the waiting mine cars of 1-m³ capacity at the drawpoints. A trolley locomotive hauls a train consisting of up to 40 mine cars to the main entry point. The sectional dimension of main haulage levels, exploratory sublevels, and tip cross-cuts will be 3.0 by 2.4 m, 2.1 by 2.1 m, and 2.4 by 1.8 m, respectively. As the working places would be above the adit level, gravity drainage could be used.

Compressed-air with a pressure of 7 kg/cm² is supplied to the working places. Fluorescence lamps are used for partial lighting in the main levels, whilst lighting in other underground workings is secured by cap lamps.

(1) Capital costs

The estimates of capital costs required for an annual output of 60,000 tons and 120,000 tons of ore are shown in Table 14. Further, the breakdown of the investment items in respective capital categories is given in Table 15.

Table 14. The estimates of capital costs for the annual production of 60,000 tons and 120,000 tons

Investment category		Annual output	
		60,000 tons	120,000 tons
Division	Subdivision	Costs (Rs.)	Costs (Rs.)
Mining	Mining equipment	11,639,000	20,994,000
	Transport plant and equipment	28,560,000	49,840,000
	Maintenance of plant & equipment	18,094,000	34,331,000
	Exploratory equipment	1,428,000	2,142,000
	Reserve fund for development	11,879,000	23,758,000
	Subtotal	71,600,000	131,065,000
Crushing	Crushing plant and equipment	31,803,000	31,803,000
	Subtotal	31,803,000	31,803,000
Administration	Assaying laboratory	2,857,000	2,857,000
	Administrative office	15,357,000	15,357,000
	Construction-related costs	31,944,000	31,944,000
	Subtotal	50,158,000	50,158,000
Total		153,561,000	213,026,000

(2) Manpower and Average Personnel Expenses

Table 16 shows the estimates of manpower required for an annual output of 60,000 tons and 120,000 tons of ore. Average monthly wages of employees in the mining, crushing, and administrative divisions are estimated at Rs. 4,625, Rs. 3,000, and Rs. 5,000, respectively.

(3) Production costs

Table 17 shows the estimates of production costs calculated under the following preconditions:

- The construction of the access road to the mining site be financed at public expense;
- Financial and technical assistance be provided by foreign sources from the planning stage of the mine development;
- The expenses for the past explorations in the Tarnwai-Lagarban area be written off;
- The interest rate on the costs of plant and equipment and the working capital be 3 %;
- A-month-long working capital be secured;
- The costs of plant and equipment be depreciated at a fixed rate over ten years.

Table 15. The breakdown of the capital costs required for annual outputs of 60,000 and 120,000 tons.

Investment Categories			Annual output							
			60,000 tons				120,000 tons			
Division	Subdivision	Item	Quantity	Unit	Unit price (000 Rs.)	Amount (000 Rs.)	Quantity	Unit	Unit price (000 Rs.)	Amount (000 Rs.)
Mining	Mining equipment	Rock drill	30	set	57	1,710	50	set	57	2,850
		Wooden mine car	10	set	250	2,500	20	set	250	5,000
		Loader	5	set	1,143	5,715	10	set	1,143	11,430
		Jumbo-drill	2	set	857	1,714	2	set	857	1,714
		Subtotal				11,639				20,994
	Transport plant and equipment	Steel mine car	40	set	114	4,560	60	set	114	6,840
		Locomotive	1	set	20,000	20,000	2	set	17,500	35,000
		Rail	1,000	m	4	4,000	2,000	m	4	8,000
		Subtotal				28,560				49,840
	Maintenance of plant & equipment	Compressor	3	set	1,857	5,571	5	set	1,857	9,285
		Supply pump	2	set	143	286	4	set	143	572
		Generator	1	set	1,714	1,714	2	set	1,714	3,428
		Air pipeline	1,500	m	0.429	644	3,000	m	0.429	1,287
		Water pipeline	1,500	m	0.377	566	3,000	m	0.377	1,131
		Pit props	150	m	40	6,000	300	m	40	12,000
		Lighting cable	500	m	0.514	257	1,000	m	0.514	514
		Cap lamp	50	set	4	200	100	set	4	400
		Substation	1	set	2,857	2,857	2	set	2,857	5,714
		Subtotal				18,094				34,331
	Exploratory equipment	Drilling machine	2	set	714	1,428	3	set	714	2,142
		Subtotal				1,428				2,142
	Reserve fund for development	Haulage	200	m	6.2	1,240	400	m	6.2	2,480
		Drift	960	m	6.2	5,952	1,920	m	6.2	11,904
		Rise	630	m	7.4	4,687	1,260	m	7.4	9,374
		Subtotal				11,879				23,758
	Total						71,600			
Crushing	Crushing plant and equipment	Ore hopper	1	set	571	571	1	set	571	571
		Grizzly feeder	1	set	571	571	1	set	571	571
		Crusher	1	set	4,286	4,286	1	set	4,286	4,286
		Belt conveyor	3	set	286	858	3	set	286	858
		Screen	2	set	571	1,142	2	set	571	1,142
		Product tank	2	set	4,286	8,572	2	set	4,286	8,572
		Foundation work	1	case	1,429	1,429	1	case	1,429	1,429
		Wiring work	1	case	2,857	2,857	1	case	2,857	2,857
		Installation work	1	case	4,286	4,286	1	case	4,286	4,286
		Building	30	m2	29	870	30	m2	29	870
		Related works				6,361				6,361
		Subtotal				31,803				31,803
	Total						31,803			
Administration	Assaying laboratory	Analytical equipment	1	set	2,857	2,857	1	set	2,857	2,857
		Subtotal				2,857				2,857
	Administrative office	Office equipment	1	set	14,857	14,857	1	set	14,857	14,857
		Office building	200	m2	2.5	500	200	m2	2.5	500
		Subtotal				15,357				15,357
	Construction-related works	Ground work for mining site	10,000	m2	2	20,000	10,000	m2	2	20,000
		Related works				11,944				11,944
Subtotal						31,944				31,944
Total						50,158				50,158

Table 16 Manpower required for the annual production of 60,000 tons and 120,000 tons of ore.

Breakdown of manpower		Annual output	
		60,000 tons	120,000 tons
Division	Subdivision	Number of staff	Number of staff
Mining	Excavation of mining faces	50	100
	Excavation of levels and sublevels	35	70
	Excavation of tip cross-cuts	30	60
	Underground transport	15	30
	Maintenance of surface facilities	12	16
	Maintenance of underground facilities	15	25
	Assaying of ore	10	18
	Exploration works	15	20
	Subtotal	182	339
Crushing	Crushing of ore	5	25
	Subtotal	5	25
Administration	Supervision of materials	7	8
	Clerical works	10	12
	Managerial works	10	16
	Subtotal	27	36
Total		214	400

Table 17. The estimates of production costs for annual outputs of 60,000 and 120,000 tons.

Cost category	Annual output	
	60,000 tons	120,000 tons
	Production cost (Rs./ton)	Production cost (Rs./ton)
Mining cost	818	790
Crushing cost	108	71
Administrative cost	311	235
Exploration cost	19	17
Shipping cost	100	100
Sum of the above costs	1,356	1,213
Gross margin (10 % of the sum)	136	121
Grand total	1,492	1,334

(4) Breakdown of the production costs for annual outputs of 60,000 and 120,000 tons

The breakdown of the production costs required for annual outputs of 60,000 and 120,000 tons of phosphorite ore is given in Table 18.

Personnel costs are estimated by using average daily wages of Rs. 185, Rs. 120, and Rs. 200 for the mining, crushing and administrative divisions, respectively, and 300 working days per year.

The shipping cost of phosphate ore from the mine site to the fertilizer plant is estimated at Rs. 100 per ton. The gross margin is calculated as 10 % of the sum of mining, crushing, administrative, and shipping costs.

2-2. Magnesite Ore

It is impossible to secure a steady supply of ore to the fertilizer plant by the present mining method adopted in the Kumhar mine. Firstly, the narrow lane leading from the Abbottabad-Sherwan Highway to the mine is required to be widened along the whole section. Secondly, a new transport road should be branched off at a point about 1 km before the mine office to lead to an intermediate level between the Lens I and II. A bench-cut method is recommendable for the mining of ore. A bench is expected to be 3 m high and 40 m long.

The estimates of the capital costs, their breakdown, manpower, and production costs required for an annual output of 24,000 ton of ore are shown in Tables 19 to 22. The preconditions applied to estimation of the production costs of magnesite ore are the same as those of the phosphorite ore.

Table 18 The breakdown of production costs required for annual outputs of 60,000 and 120,000 tons of ore.

Cost Categories		Annual Output							
		60,000 tons				120,000 tons			
Division	Items	Consumption to produce a ton of ore (ton/ton) (A)	Unit price (Rs/ton) (B)	Total costs to produce 60,000 tons of ore (Rs) (C)=(A)*(B)	Production cost (Rs/ton) (C/60,000)	Consumption to produce a ton of ore (ton/ton) (A)	Unit price (Rs/ton) (B)	Total costs to produce 120,000 tons of ore (Rs) (C)=(A)*(B)	Production cost (Rs/ton) (C/120,000)
Mining	Explosion	0.51 (kg/t)	55 (Rs/kg)	1,681,500	28	0.51 (kg/t)	55 (Rs/kg)	3,060,000	25
	Electricity (generator)	1.85 (kwh/t)	60 (Rs/kwh)	6,900,000	115	1.85 (kwh/t)	60 (Rs/kwh)	13,320,000	111
	Drill rod	0.07 (piece/t)	2000 (Rs/piece)	8,40,000	14	0.07 (piece/t)	2000 (Rs/piece)	16,80,000	14
	Drill bit	0.02 (piece/t)	2300 (Rs/piece)	2,66,000	4	0.02 (piece/t)	2300 (Rs/piece)	4,60,000	4
	Electricity (charge)	40 (kwh/t)	2.7 (Rs/kwh)	6,150,000	102	40 (kwh/t)	2.7 (Rs/kwh)	12,960,000	108
	Expensibles	1 (t/t)	30 (Rs/t)	1,80,00,000	30	1 (t/t)	30 (Rs/t)	3,60,00,000	30
	Subtotal			27,423,000	457	Subtotal		54,846,000	457
	Wages	182 man*(25*12) day / 60,000 ton	Rs / man day			182 man*(25*12) day / 120,000 ton	Rs / man day		
		0.91	185	10,50,100	175	0.91	185	18,814,500	157
	Subtotal			10,50,100	175	Subtotal		18,814,500	157
	Depreciation (period 10 years)			7,16,100	12	Depreciation (period 10 years)		11,04,500	9
	Costs of repairs (5 % of mining capital costs)			2,154,930	36	Costs of repairs		4,309,860	36
	Subtotal			9,818,070	164	Subtotal		17,818,460	148
	Total of direct production costs			46,862,830	781	Direct production costs		96,698,970	798
Crushing	Interest on mining capital costs (5 %)			2,154,930	36	Interest on mining capital costs		4,309,860	36
	Interest on working capital (direct production costs/12)			117,155	2	Interest on working capital		226,310	2
	Subtotal			2,272,085	38	Subtotal		4,536,170	38
	Total			49,134,915	819	Total		94,235,140	790
	Electricity (charge)	5 (kwh/t)	2.7 (Rs/kwh)	810,000	14	5 (kwh/t)	2.7 (Rs/kwh)	1,620,000	14
	Expensibles	1 (t/t)	6 (Rs/t)	3,60,000	6	1 (t/t)	6 (Rs/t)	7,20,000	6
	Subtotal			1,170,000	20	Subtotal		2,340,000	20
	Wages	3 man*(25*12) day / 60,000 ton	Rs / man day			3 man*(25*12) day / 120,000 ton	Rs / man day		
		0.03	120	180,000	3	0.03	120	900,000	8
	Subtotal			180,000	3	Subtotal		990,000	8
	Depreciation (period 10 years)			3,178,500	53	Depreciation (period 10 years)		3,180,500	27
	Costs of repairs (5 % of mining capital costs)			931,580	16	Costs of repairs		934,040	8
	Subtotal			4,110,080	69	Subtotal		4,114,540	34
	Sum of direct production costs			5,482,180	91	Direct production costs		7,374,540	61
Administration	Interest on mining capital costs (5 %)			931,580	16	Interest on mining capital costs		934,040	8
	Interest on working capital (direct production costs/12)			13,703	0	Interest on working capital		221,232	2
	Subtotal			945,283	16	Subtotal		1,155,272	10
	Total			6,447,463	107	Total		8,529,812	71
	Expensibles	1 (t/t)	150 (Rs/t)	9,00,000	150	1 (t/t)	150 (Rs/t)	18,00,000	150
	Subtotal			9,00,000	150	Subtotal		18,00,000	150
	Wages	27 man*(25*12) day / 60,000 ton	Rs / man day			27 man*(25*12) day / 120,000 ton	Rs / man day		
		0.14	200	1,620,000	27	0.14	200	2,160,000	18
	Subtotal			1,620,000	27	Subtotal		2,160,000	18
	Depreciation (period 10 years)			3,015,900	50	Depreciation (period 10 years)		4,015,800	33
	Costs of repairs (5 % of mining capital costs)			1,504,740	25	Costs of repairs		1,504,740	13
	Subtotal			4,520,640	75	Subtotal		5,520,540	46
	Total of direct production costs			17,322,290	289	Direct production costs		26,649,540	222
	Interest on mining capital costs (5 %)			1,549,800	26	Interest on mining capital costs		1,549,800	13
Exploration	Subtotal			1,549,800	26	Subtotal		1,549,800	13
	Total			18,872,090	315	Total		28,199,340	235
	Level	Level length (A)	Unit price (B)	Total costs to produce 60,000 tons of ore (Rs) (C)=(A)*(B)	Production cost (Rs/ton) (C/60,000)	Level length (A)	Unit price (B)	Total costs to produce 120,000 tons of ore (Rs) (C)=(A)*(B)	Production cost (Rs/ton) (C/120,000)
	Deep	295 m	1,000 Rs/m	1,10,45,000	184	520 m	1,000 Rs/m	2,21,00,000	184
	Adit	200 m	3,380 Rs/m	7,76,000	13	200 m	3,380 Rs/m	7,76,000	6
	Road	315 m	2,996 Rs/m	9,43,740	16	400 m	2,996 Rs/m	1,19,84,000	10
	Crosscut	40 m	3,380 Rs/m	1,35,200	2	80 m	3,380 Rs/m	3,10,400	3
	Shuttle haulage	100 m	3,380 Rs/m	3,38,000	6	200 m	3,380 Rs/m	7,76,000	6
	Total costs			3,58,740	6	Total costs		5,96,140	5
	Exploration costs- 1/3 of the total costs			1,122,913	19	Exploration cost		1,987,160	17
Shipping	Cargo	Cargo weight (A)	Unit price (B)	Total cost to transport 60,000 tons (Rs) (C)=(A)*(B)	Production cost (Rs/ton) (C/60,000)	Cargo weight (A)	Unit price (B)	Total cost to transport 120,000 tons (Rs) (C)=(A)*(B)	Production cost (Rs/ton) (C/120,000)
	phosphate ore	1 ton	100 Rs/ton	6,00,000	10	1 ton	100 Rs/ton	12,00,000	10
	Total			6,00,000	10	Total		12,00,000	10
Gross margin	Total costs from mining to shipping			81,587,773	1,359			1,65,579,779	1,379
	Gross margin- Total costs*10 %			8,158,777	136			16,557,980	137
Grand Total of Production Costs				89,746,550	1,495	Grand Total			

Table 19 The estimates of capital costs for the annual production of 24,000 tons of magnesite ore.

Division	Subdivision	Costs (Rs.)
Mining	Mining equipment	16,714,000
	Transport equipment	2,143,000
	Reserve fund for development	2,829,000
	Subtotal	21,686,000
Crushing	Crushing plant & equipment	12,517,000
	Subtotal	12,517,000
Administration	Construction-related costs	2,000,000
	Subtotal	2,000,000
Total		36,203,000

Table 20 The breakdown of the capital costs for the annual output of 24,000 tons of magnesite ore.

Division	Subdivision	Item	Quantity	Unit	Unit price (,000 Rs.)	Amount (,000 Rs.)
Mining	Mining equipment	Jack hammer	1	set	1,249	1,249
		Power shovel	1	set	4,857	4,857
		Oil hydraulic breaker	1	set	5,143	5,143
		Dozer shovel	1	set	4,571	4,571
		Compressor	1	set	714	714
	Subtotal					16,714
	Transport equipment	Dump truck	1	set	2,143	2,143
		Subtotal				
	Reserve fund for development	15 % of mining and transport equipment	1		2,829	2,829
		Subtotal				
Total					38,400	
Crushing	Crushing plant & equipment	Ore hopper	1	set	143	143
		Grizzly feeder	1	set	429	429
		Jaw crusher	1	set	1,714	1,714
		Belt conveyor	3	set	229	687
		Screen	2	set	571	1,142
		Ground works	1	case	429	429
		Electric machinery	1	set	571	571
		Substation	1	set	1,000	1,000
		Installation	1	case	4,286	4,286
		Building	30	m ²	1	30
		Ground works	1	case	2,086	2,086
		Total				
	Administration	Construction-related costs	Transport road	1		1,500
Dump site			1		500	500
Total					2,000	
Grand total						36,203

Table 21. Manpower required for the annual production of 24,000 tons of magnesite ore.

Division	Subdivision	Number of staff
Mining	Excavation of mining faces	4
	Maintenance of surface facilities	1
	Subtotal	3
Crushing	Crushing of ore	2
	Subtotal	2
Administration	Clerical works	2
	Managerial works	1
	Subtotal	3
Total		10

Table 22. The estimates of production costs for annual outputs of 24,000 of magnesite ore

Items	Consumption to produce a ton of ore (unit/ton) [A]	Unit price (Rs /unit) [B]	Total costs to produce 60,000 tons of ore (Rs) [C]=[A]*[B]*24,000	Production costs (Rs /ton) [C]/24,000
Explosives	0.12 (kg/t)	55 (Rs/kg)	158,400	7
Electric detonator	0.025 (piece/t)	60 (Rs/piece)	36,000	2
Fuel	1 (lt/t)	3 (Rs/lt)	72,000	3
Expendable	1 (set/t)	20 (Rs/set)	480,000	20
Electricity charge	5 (kW/t)	3.7 (Rs/kW)	444,000	19
Subtotal			1,190,400	50
Wages	10 man*(25*12) day / 60,000 ton	Rs / man day		
	0.125	120	360,000	15
Subtotal			360,000	15
Depreciation (period 10 years)			3,620,300	151
Costs of repairs (3 % of capital costs)			724,060	30
Subtotal			4,344,360	181
Total of direct production costs			5,894,760	246
Interest on capital costs (3 %)			1,086,090	45
Interest on working capital (direct production costs/12) (3 %)			14,737	1
Subtotal			1,100,827	46
Shipping cost	1	100	2,400,000	100
Gross margin = (direct production costs+interests+shipping cost)*0.1			939,559	39
Grand total			10,335,146	431

2-3. Quartzite

The present manufacturing method, which substitutes serpentinite as a raw material by magnesite to utilize low-grade phosphate ore, requires an addition of 40 to 60 kg of silica to raise the fluidity of the melt as previously mentioned. Since there occurs a lot of quartzite around the Kumhar mine, the facilities for mining magnesite could be applied to mine it. Consequently, the same mining cost as that of magnesite, i.e. Rs. 431 per ton, was tentatively adopted.

2-4. Summary for Mine Planning

As the Haripur plant of NFC has used both local and imported ores of phosphorite to manufacture SSP, SDA has been demanded a reasonable pricing to offset the poorer grade as a local supplier by NFC. In order to secure as competitive pricing as possible, the mine development to guarantee an annual output of 120,000 ton of ore is desirable. Judging from the lack of a sufficient access road to the mine site, it is considered to be difficult to implement the project without financial and technical supports from internal and external sources.

ESTIMATION OF MANUFACTURING COSTS OF FMP

1. Comparison Between Electric Furnace Method and Fuel Method

Table 23 indicates a comparison of the production costs of FMP and the difficulty of maintenance of the plant between the electric furnace method and the fuel method using an open hearth furnace.

Table 23. Comparison of the production costs of FMP and the plant maintenance between the electric furnace method and fuel method.

	Capital Cost	Energy cost	Repair cost	Maintenance technique	Total costs	
					Pakistan	Japan
Electric furnace method	low	high	low	easy	low	high
Fuel method	high	low	high	difficult	high	low

As electricity charge is far more expensive than the price of oil coke used as fuel of an open hearth furnace in Japan, the fuel method is preferable to the electric furnace method there as a whole. On the contrary, the electric furnace method is better than the fuel method in Pakistan. For the unit cost of electricity is higher than that of heavy oil or natural gas in Pakistan, but the capital costs, their depreciation cost, and the interest on them in the electric furnace method is so cheaper than those of the fuel method as to more than compensate the difference in energy cost. Further, the maintenance of the plant and equipment of electric furnaces is easier than that of fuel furnaces.

However, the Ministry of Petroleum and Natural Resources recommended to adopt heavy oil as the energy resource for manufacturing FMP because of a short supply of electricity and natural gas.

As a generator in the 10,000 kW class is necessary to privately supply energy to the electric furnace, the capital costs are not only equalized with the fuel method but the unit cost of generated electricity also exceeds that of utility supply, so that the above-mentioned advantages of the fuel method is nullified. Furthermore, a private power generation requires a state-of-art technique of maintenance.

Consequently, it is recommendable to adopt a fuel method using heavy oil in Pakistan. As a round-the-clock operation, however, is premised for an open hearth furnace, the installation of supplementary generators which can supply 900 kW/h of electricity is indispensable for emergency in Pakistan where frequent power cuts take place. It is understood to be possible for local mechanics to maintain a diesel generator in the 500 kW class.

2. Quality Planning of FMP

The main objective of the present project consists in utilizing low grade phosphate ore. With a targeted content of 20 % of P_2O_5 , it is desirable to not only use as wide a grade range of phosphate ore as possible but also keep the production costs as low as possible.

Further, alkaline soils are so dominant in Pakistan that less magnesium deficiency diseases would be expected than in Japan. Therefore, a quality design of FMP is desirable to not only keep the magnesium content as low as possible but also raise the content of silica that is not available in other fertilizers as high as possible. The targeted content of Pakistan-made FMP and the required contents of raw ores are shown in Tables 24 and 25, respectively.

Table 24. The guaranteed content of Pakistani-made FMP.

P_2O_5	MgO	SiO_2	Alkali
20.0 %	15.0 %	25.0 %	45.0 %

$$\text{Alkali} = \text{CaO} + 1.39 * \text{MgO}$$

Table 25. The contents of raw materials used to produce the FMP with the above guaranteed content

	P_2O_5	MgO	SiO_2	Ignition residue	Al_2O_3
Phosphorite	24.3 %	2.4 %	25.3 %	7.6 %	3.7 %
Magnesite		42.3 %	1.2 %	49.1 %	0.3 %
Quartzite		0.5 %	93.8 %	0.1 %	4.7 %

Thus, even silica-rich phosphorite ore is very welcome for the production of FMP unlike SSP. Otherwise, some addition of quartzite is necessary to increase the fluidity of the melt. As contamination of dolomite, however, raises the melting point of the raw materials, it is not preferable. A high content of alumina, which lowers the solubility of FMP in acid, is also undesirable. Grain size of less than 20 mm prompts the contact melting between the ore particles, but a very high content of powdery ore decreases the repose angle of the materials to lower the heat conduction area in the furnace and inflict a harmful effect on the production efficiency of FMP.

A designed mixing ratio of the raw materials and the expected composition of the final product are shown in Table 26.

Table 26. A mixing ratio of the raw materials and the expected composition of the obtained product.

Raw material	Mixing ratio (kg/ton)	P_2O_5	MgO	SiO_2	CaO	Alkali
Phosphorite	904	20.3 %	15.5 %	25.2 %	30.9 %	53.1 %
Magnesite	3.46					
Quartzite	38					

3. Capital Costs for manufacturing FMP

The technical level in Pakistan is deemed to be high enough to produce most of the plant and equipment according to appropriate blue prints except for some special machinery. Consequently, the manufacturing plant of FMP is premised to be locally constructed on the basis of a granted basic technology. Refractory bricks for the open hearth furnace are also expected to be procured in the local market.

The capital costs are estimated at about half those needed in Japan. The following items are excluded from the capital cost:

- 1) technical consultant fee;
- 2) plant premises and its ground work;
- 3) substation outside the plant premises;
- 4) access road to the plant;
- 5) sewer outside the plant;
- 6) supply of drinking water;
- 7) import duties and sales taxes on the equipment.

Pollution prevention facilities as shown in Table 27 will be installed to follow the emission and effluent standards applied to new factories constructed after July 1, 1994.

Table 27. Emission and effluent standards applied to newly built factories.

Emission standards		Effluent standards	
Dust	500 mg/Nm ³	Temperature	40°C
H ₂ S	150 mg/Nm ³	pH	6-10
SO _x	400 mg/Nm ³	COD	150 mg/l
NO _x	400 mg/Nm ³	Cl	1,000 mg/l
		F	20 mg/l
		SO ₄	600 mg/l

The estimates of capital costs for a plant to manufacture 62,000 tons per year is given in Table 28.

Table 28. The estimates of capital costs required for an annual output of 62,000 tons of FMP.

Main plant and equipment	Amount	Main plant and equipment	Amount
Machinery (Depreciation: 10 years)		Buildings (Depreciation: 20 years)	
Material processing	37,900,000	Foundation work	7,600,000
Fuel supply	11,300,000	Framing	6,600,000
Ore melting	127,700,000	Factory and office buildings	46,900,000
Melt cooling	36,900,000	Tree planting	1,400,000
Purification of emission and effluent	18,800,000	Warehouse and others	3,600,000
Product drying	21,500,000	Generator room	3,100,000
Packing	27,700,000	Subtotal	69,200,000
Transport and installation	5,900,000	Transportation (Depreciation: 8 years)	
Plumbing	8,700,000	Transport vehicles	7,100,000
Wiring	28,100,000	Subtotal	7,100,000
Gauge setting	56,900,000	Power generation (Depreciation: 15 years)	
Furnace insulation	2,100,000	Power generator	84,000,000
Painting	1,700,000	Subtotal	84,000,000
Miscellaneous works	3,800,000		
analytical equipment	16,800,000		
Subtotal	405,800,000		
Grand total			566,100,000

4. Estimates of Manpower and Personnel Expenses

The number of the staff totals 73 including a president in the manufacturing plant. The staff is divided into two departments: management and manufacturing. The former is staffed with 9 members including the president, whilst the latter with 64 members. The organization of the manufacturing plant and the estimates of the personnel expenses are given in Figure 24 and Table 29, respectively. When no generator is used, a division

chief and three workers can be reduced from the payroll. Besides the above regular full-timers, wages of some part-timers are included in the production costs.

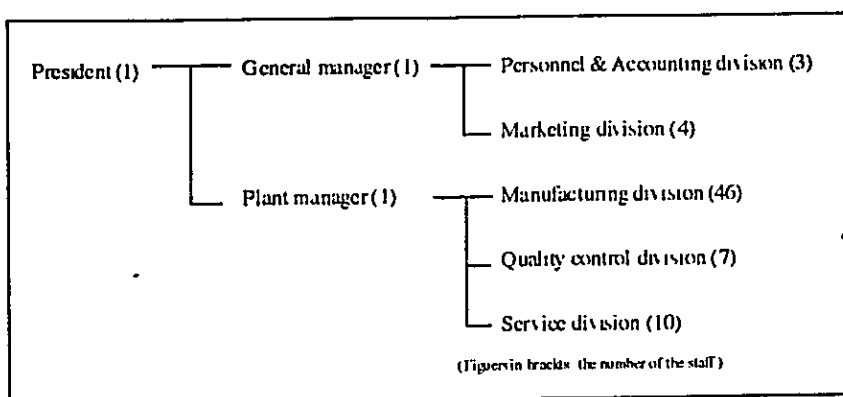


Figure 24. The organization of the manufacturing plant of FMP.

Table 29. the estimate of personnel expenses for the manufacturing plant of FMP.

Job classification	Number	Salary (Rs./month)	Personnel expenses (Rs./year)
President	1	15,000	180,000
Manager	2	10,000	240,000
Division chief	5	8,000	480,000
Foreman	9	6,000	648,000
Workers	56	4,000	2,688,000
Total	73		4,236,000

5. Manufacturing Costs of FMP

The manufacturing costs are calculated under the following preconditions:

- annual interest rate on the capital costs be 3 %;
- annual interest rate on the working capital equivalent to a-month-long direct production costs be 3 %;
- the capital costs be depreciated as shown in Table 30.

Table 30. The breakdown of depreciation of the capital costs.

Items	Amount (,000 Rs.)	Period (years)	Annual Depreciation (,000 Rs.)
Machinery	405,800	10	40,580
Vehicles	7,100	8	888
Power generator	84,000	15	5,600
Building	69,200	20	3,460
Total	566,100		50,528

Tables 31 and 32 give the estimates of production costs of FMP for the purchasing prices of Rs. 1,492/ton and Rs. 1,334/ton, respectively, with a private generator. Respective production costs of FMP are estimated at Rs. 3,747/ton and Rs. 3,604/ton. Tables 33 and 34 show the production costs for the two cases without private power generation, which are estimated at Rs. 3,572/ton and Rs. 3,428/ton, respectively.

Table 31. A cost estimation for manufacturing FMP by using a power generator and purchasing phosphate ore for Rs. 1,492/ton.

Items	Consumption to produce a ton of FMP (unit/ton) (A)	Unit price (Rs./unit) (B)	Total costs to produce 62,000 tons of FMP (Rs.) (C)=(A)*(B)*62,000	Production costs (Rs./ton) (C)/62,000
Phosphorite	0.904 (ton/ton)	1,492 (Rs./ton)	83,623,616	1,349
Magnesite	0.346 (ton/ton)	431 (Rs./ton)	9,245,812	149
Quartzite	0.038 (ton/ton)	431 (Rs./ton)	1,015,436	16
Slaked lime	0.035 (ton/ton)	1,200 (Rs./ton)	2,604,000	42
Heavy oil	0.160 (kl/ton)	2,960 (Rs./kl)	29,363,200	474
Electricity charge	0.107 (KW/ton)	922 (Rs./KW)	6,116,548	99
Expendable	1.000 (set/ton)	47 (Rs./set)	2,914,000	47
Packing cost	1.000 (set/ton)	124 (Rs./set)	7,688,000	124
Subtotal			142,570,612	2,300
Wage for full-timers	73 man*(25*12) day/62,000 ton	Rs./man day		
	0.353	193	4,236,000	68
Wage for part-timers			496,000	8
Subtotal			4,732,000	76
Depreciation (periods: 8, 10, 15, 20 years)			50,528,000	815
Costs of repairs (3 % of FMP plant capital costs)			16,983,000	274
Subtotal			67,511,000	1,089
Total of direct production costs			214,813,612	3,465
Interest on the capital costs (3%)			16,983,000	274
Interest on working capital (direct production costs/12) (3 %)			537,034	9
Subtotal			18,398,250	283
Grand total			232,715,862	3,747

Table 32. A cost estimation for manufacturing FMP by using a power generator and purchasing phosphate ore for Rs. 1,334/ton.

Items	Consumption to produce a ton of FMP (unit/ton) (A)	Unit price (Rs./unit) (B)	Total costs to produce 62,000 tons of FMP (Rs.) (C)=(A)*(B)*62,000	Production costs (Rs./ton) (C)/62,000
Phosphorite	0.904 (ton/ton)	1,334 (Rs./ton)	83,623,616	1,206
Magnesite	0.346 (ton/ton)	431 (Rs./ton)	9,245,812	149
Quartzite	0.038 (ton/ton)	431 (Rs./ton)	1,015,436	16
Slaked lime	0.035 (ton/ton)	1,200 (Rs./ton)	2,604,000	42
Heavy oil	0.160 (kl/ton)	2,960 (Rs./kl)	29,363,200	474
Electricity charge	0.107 (KW/ton)	922 (Rs./KW)	6,116,548	99
Expendable	1.000 (set/ton)	47 (Rs./set)	2,914,000	47
Packing cost	1.000 (set/ton)	124 (Rs./set)	7,688,000	124
Subtotal			133,715,028	2,157
Wage of full-timers	73 man*(25*12) day/62,000 ton	Rs./man day		
	0.353	193	4,236,000	68
Wage of part-timers			496,000	8
Subtotal			4,732,000	76
Depreciation (periods: 8, 10, 15, 20 years)			50,528,000	815
Costs of repairs (3 % of FMP plant capital costs)			16,983,000	274
Subtotal			67,511,000	1,089
Total of direct production costs			205,958,028	3,322
Interest on the capital costs (3%)			16,983,000	274
Interest on working capital (direct production costs/12) (3 %)			514,896	8
Subtotal			17,497,895	282
Grand total			223,455,923	3,604

Table 33. A cost estimation for manufacturing FMP by using no generator and purchasing phosphate ore for Rs. 1,492/ton.

Items	Consumption to produce a ton of FMP (unit/ton) (A)	Unit price (Rs./unit) (B)	Total costs to produce 62,000 tons of FMP (Rs.) (C)=(A)*(B)*62,000	Production costs (Rs./ton) (C)/62,000
Phosphorite	0.904 (ton/ton)	1,492 (Rs./ton)	83,623,616	1,349
Magnesite	0.346 (ton/ton)	431 (Rs./ton)	9,245,812	149
Quartzite	0.038 (ton/ton)	431 (Rs./ton)	1,015,436	16
Slaked lime	0.035 (ton/ton)	1,200 (Rs./ton)	2,604,000	42
Heavy oil	0.160 (kl/ton)	2,960 (Rs./kl)	29,363,200	474
Electricity charge	0.107 (KW/ton)	922 (Rs./KW)	6,116,548	99
Expendable	1.000 (set/ton)	47 (Rs./set)	2,914,000	47
Packing cost	1.000 (ton/ton)	124 (Rs./set)	7,688,000	124
Subtotal			142,570,612	2,300
Wage for full-timers	69 man*(25*12) day/62,000 ton	Rs./man day		
	0.334	193	4,002,348	65
Wage for part-timers			496,000	8
Subtotal			4,498,348	73
Depreciation (periods: 8, 10, 20 years)			44,928,000	725
Costs of repairs (3 % of FMP plant capital costs)			14,463,000	233
Subtotal			59,391,000	958
Total of direct production costs			206,459,960	3,330
Interest on the capital costs (3%)			14,463,000	233
Interest on working capital (direct production costs/12) (3 %)			516,150	8
Subtotal			14,979,150	242
Grand total			221,439,110	3,572

Table 34. A cost estimation for manufacturing FMP by using no generator and purchasing phosphate ore for Rs. 1,334/ton.

Items	Consumption to produce a ton of FMP (unit/ton) (A)	Unit price (Rs./unit) (B)	Total costs to produce 62,000 tons of FMP (Rs.) (C)=(A)*(B)*62,000	Production costs (Rs./ton) (C)/62,000
Phosphorite	0.904 (ton/ton)	1,334 (Rs./ton)	83,623,616	1,206
Magnesite	0.346 (ton/ton)	431 (Rs./ton)	9,245,812	149
Quartzite	0.038 (ton/ton)	431 (Rs./ton)	1,015,436	16
Slaked lime	0.035 (ton/ton)	1,200 (Rs./ton)	2,604,000	42
Heavy oil	0.160 (kl/ton)	2,960 (Rs./kl)	29,363,200	474
Electricity charge	0.107 (KW/ton)	922 (Rs./KW)	6,116,548	99
Expendable	1.000 (set/ton)	47 (Rs./set)	2,914,000	47
Packing cost	1.000 (ton/ton)	124 (Rs./set)	7,688,000	124
Subtotal			133,715,028	2,157
Wage for full-timers	69 man*(25*12) day/62,000 ton	Rs./man day		
	0.334	193	4,002,348	65
Wage for part-timers			496,000	8
Subtotal			4,498,348	73
Depreciation (periods: 8, 10, 20 years)			44,928,000	725
Costs of repairs (3 % of FMP plant capital costs)			14,463,000	233
Subtotal			59,391,000	958
Total of direct production costs			197,604,376	3,187
Interest on the capital costs (3%)			14,463,000	233
Interest on working capital (direct production costs/12) (3 %)			516,150	8
Subtotal			14,979,150	242
Grand total			212,561,387	3,428

ESTIMATION OF THE PROFITABILITY OF THE FMP PROJECT IN PAKISTAN

Tables 31 and 32 show two case studies on production costs for manufacturing FMP by purchasing phosphorite ore for Rs. 1,492/ton and Rs. 1,334/ton. The both cases premise to have a private generator for emergency. On the other hand, Tables 33 and 34 give two cost estimations to manufacture FMP by completely depending the supply of supplementary energy on WAPDA and purchasing phosphorite ore for two different prices, which correspond to an annual output of 60,000 tons and 120,000 tons, respectively. In the latter case, the half of ore output is consumed by FMP and the remainder by SSP.

As a matter of fact, the four production costs listed in Tables 31 to 34 indicate those for the first month of operation. In reality, if a fixed amount of money set aside for the depreciation of the capital costs is monthly refunded to the bank, the loan balance diminishes month by month and the interest on the loan is also correspondingly reduced for the subsequent months, resulting in reduction of the production costs.

In this chapter, we will discuss on the effects of the following four factors on the profitability of the manufacturing of FMP: (1) purchasing price of material ores such as phosphorite, magnesite, and quartzite, (2) private power generation for emergency, (3) reduction or cut of the government subsidy to fertilizers in the near future, and finally (4) substituting the fuel method by an electric furnace method which is not only cheaper in capital cost but also easier in maintenance than the former. Details are given as under.

1. Cost Effect of Purchasing Price of Ores

The above-mentioned production costs of material ores such as phosphorite, magnesite, and quartzite include a gross margin of 10 percent. Table 35 shows a comparison of gross margins between phosphorite, magnesite and FMP on the condition of 3 % of annual interest on the capital costs for mining of raw ores and manufacturing of FMP. The table is divided into two parts. The first and second parts show the gross margin of FMP compared with 10 percent and 5 percent of gross margin included in the ex-factory price of phosphorite and magnesite, respectively. Since the production cost of FMP is greatly affected by the capital cost of an electric generator as a supplementary energy source and a big difference in purchasing price of phosphorite depending on its annual output, each part is subdivided into four cases depending upon whether an electric generator is used or not and two kinds of annual outputs of phosphorite.

Further, the gross margin is divided into two: initial gross margin (IGM) and total gross margin (TGM). The former is those as shown in the tables of the estimation of production costs of phosphorite and magnesite. In reality, however, actual production costs of the ores are diminished month by month by a reduction in the interest on the capital costs as stated above, so that a considerable amount of profit will be accumulated until the loan of the capital costs are refunded. The total gross margin (TGM) shown in this table is defined as the ratio of the accumulated profit to the total production costs required for the whole period of loan refunding. Details of the calculation of TGM are given in Tables 1 and 2 for magnesite, Tables 3 to 6 for phosphorite, and Tables 7 to 14 for FMP in the appendix.

Table 35. A comparison of gross margin rates between phosphorite, magnesite, and FMP

Type of power supply	Annual output of phosphate (ton year)	Phosphorite ore		Magnesite ore		FMP	
		IGM	TGM	IGM	TGM	IGM	TGM
Private	60,000	10.00%	14.62%	10.00%	16.28%	-3.93%	-2.12%
Public	60,000	10.00%	14.62%	10.00%	16.28%	0.80%	3.90%
Private	120,000	10.00%	13.90%	10.00%	16.28%	-0.11%	3.55%
Public	120,000	10.00%	13.90%	10.00%	16.28%	5.00%	8.58%
Private	60,000	5.00%	9.14%	5.00%	11.00%	-2.12%	0.84%
Public	60,000	5.00%	9.14%	5.00%	11.00%	2.79%	6.08%
Private	120,000	5.00%	8.72%	5.00%	11.00%	1.64%	5.44%
Public	120,000	5.00%	8.72%	5.00%	11.00%	6.94%	10.51%

This table indicates how worse the profitability of FMP manufacturing is than that of phosphorite and magnesite. Only the case where the annual output of phosphorite is 120,000 tons, a gross margin of 5 % is included into the ex-factory price of material ores, and a supplementary energy for the manufacturing of FMP is supplied only by WAPDA makes the profitability of FMP comparable to that of phosphorite and magnesite.

Table 36. A comparison between various cases where interest rates, capital costs, and purchasing prices of ores including a gross margin of 5 % are different from each other.

Interest rate	Items for comparison	Annual output of 60,000 t/y of phosphate ore		Annual output of 120,000 t/y of phosphate ore	
		Private power supply	Public power supply	Private power supply	Public power supply
	Capital cost (Rs)	566,100,000	482,100,000	566,100,000	482,100,000
	Annual depreciation (Rs)	50,528,000	44,928,000	50,528,000	44,928,000
3.0%	Table number in appendix	Table 11	Table 12	Table 13	Table 14
	Initial unit production cost (Rs./ton)	3,678	3,502	3,542	3,366
	Term of loan redemption (month)	165	156	165	156
	Initial gross margin rate (%)	-2.12%	2.79%	1.64%	6.94%
	Total gross margin rate (%)	0.84%	6.08%	5.44%	10.51%
	Accumulated profit after redemption (Rs)	25,627,011	166,366,626	158,211,016	275,933,460
	Period of loss (month)	66	0	0	0
3.5%	Table number in appendix		Table 15	Table 16	Table 17
	Initial unit production cost (Rs./ton)		3,570	3,610	3,428
	Term of loan redemption (month)		162	171	162
	Initial gross margin rate (%)		0.84%	-0.28%	5.03%
	Total gross margin rate (%)		4.49%	3.91%	9.00%
	Accumulated profit after redemption (Rs)		129,570,331	1109,671,488	248,710,549
	Period of loss (month)		0	8	0
4.0%	Table number in appendix		Table 18		Table 19
	Initial unit production cost (Rs./ton)		3,638		3,488
	Term of loan redemption (month)		169		169
	Initial gross margin rate (%)		-1.04%		3.20%
	Total gross margin rate (%)		2.94%		7.54%
	Accumulated profit after redemption (Rs)		89,709,824		220,385,502
	Period of loss (month)		27		0
4.5%	Table number in appendix				Table 20
	Initial unit production cost (Rs./ton)				3,549
	Term of loan redemption (month)				177
	Initial gross margin rate (%)				1.44%
	Total gross margin rate (%)				6.10%
	Accumulated profit after redemption (Rs)				189,309,462
	Period of loss (month)				0
5.0%	Table number in appendix				Table 21
	Initial unit production cost (Rs./ton)				3,610
	Term of loan redemption (month)				185
	Initial gross margin rate (%)				-0.28%
	Total gross margin rate (%)				4.61%
	Accumulated profit after redemption (Rs)				151,530,536
	Period of loss (month)				8

2. Cost Effect of Private Power Generation

As mentioned in the previous section, the procurement of material ores including a gross margin of 10 percent exerts such an adverse effect on the profitability of FMP manufacturing that some case studies will be carried out on the assumption that the ex-factory price of the raw materials includes a gross margin of 5 % in this section.

Table 36 shows a break-even point of several cases which differ from each other in interest rate, capital cost, and purchasing price of phosphate ore. This table is divided into two classes by the annual output of the phosphate ore affecting the purchasing price, and each of the classes is further subdivided into two subclasses depending on whether a private generator is installed as a supplementary energy source. In each of them, the profitability was calculated for different interest rates ranging from 3.0 % to 5.0 %. The

shaded parts in the table show cases where the initial unit production cost is less than Rs. 3,600, which is the sum of the unit proceeds (Rs. 2,700) and the unit subsidy (Rs. 900) from the very beginning of the operation.

The calculation is made on the premise that a definite amount of money set aside for the depreciation is monthly refunded to the bank to reduce the loan balance and, in turn, the interest of the subsequent month.

Table 37. An example of the calculation tables attached in the appendix to indicate the profitability of the FMP manufacturing under various conditions.

(1) Year	(2) Month	(3) Loan balance	(4) Monthly interest (1.5% of 12)	(5) Refunded principal	(6) Direct production cost	(7) Interest on working capital	(8) Interest on depreciation	(9) Total production costs	(10) Proceeds (Rs. 2,700 ton)	(11) Investment subsidy (Rs. 900 ton)	(12) Revenue	(13) Profit and loss
1	1	482,100,000	1,406,125	2,337,875	17,183,134	50,117	1,406,125	18,639,377	17,950,000	4,650,000	18,600,000	-19,377
	2	479,762,125	1,399,306	2,344,694	17,183,134	50,117	1,399,306	18,632,558	17,950,000	4,650,000	18,600,000	-32,558
	3	477,417,431	1,392,468	2,351,532	17,183,134	50,117	1,392,468	18,625,719	17,950,000	4,650,000	18,600,000	-25,719
	4	475,065,899	1,385,609	2,358,391	17,183,134	50,117	1,385,609	18,618,861	17,950,000	4,650,000	18,600,000	-18,861
	5	472,707,508	1,378,730	2,365,270	17,183,134	50,117	1,378,730	18,611,982	17,950,000	4,650,000	18,600,000	-11,982
	6	470,342,238	1,371,832	2,372,168	17,183,134	50,117	1,371,832	18,605,083	17,950,000	4,650,000	18,600,000	-5,083
14	160	10,020,896	29,228	3,714,772	17,183,134	50,117	29,228	17,262,479	13,950,000	4,650,000	18,600,000	1,337,521
	161	6,306,124	18,393	3,725,607	17,183,134	50,117	18,393	17,251,645	13,950,000	4,650,000	18,600,000	1,348,355
	162	2,580,517	7,527	2,580,517	17,183,134	50,117	7,527	17,240,778	13,950,000	4,650,000	18,600,000	1,359,222
	Total		123,272,043	482,100,000	2,783,667,762	8,119,031	123,272,043	2,915,036,846	2,259,900,000	53,300,000	3,014,200,000	98,141,154

Table 37 demonstrates the top and bottom parts of one of the calculation tables attached in the appendix. The first and second columns represent the number of years and months required for redemption of the loan. The loan balance in the third column is reduced by an amount of the refunded principal in the fifth column every month, which is equal to the remainder after subtracting the monthly interest from a fixed amount of monthly depreciation. Consequently, the loan balance and monthly interest diminish month after month, whereas the refunded principal grows until the total sum is equalized with the initial loan balance. The direct production costs in the sixth column are invariable as long as the price of raw materials, wages, energy cost, and interest rate remain unchanged as shown in Tables 31 to 34. However, the purchasing prices of ores increase with a rise of interest rate on the capital costs for mining as shown in Table 38. Therefore, the direct production costs of FMP also go up with an increase in price of ores as shown in Table 39.

Table 38. Variation in unit production costs of phosphate and magnesite ores with a change in gross margin rate and interest rate.

Change in gross margin rate and interest rate.							
Gross margin rate	10%		5%				
Interest rate	3 0%	3 0%	3 5%	4 0%	4 5%	5 0%	5 5%
Phosphate (60,000 ton/y)	1,492	1,423	1,451	1,478	1,505	1,533	1,560
Phosphate (120,000 ton/y)	1,334	1,274	1,294	1,313	1,332	1,352	1,371
Magnesite (24,000 ton/y)	431	411	419	427	435	443	451
(unit: Rs/ton)							

(unit: Rs./ton)

Table 39. Variation in direct production costs of FMP with a change in gross margin rate of ores and interest rate on capital costs (unit: Rs.).

Gross margin rate of ores	Power supply	Annual output of phosphate ore	3.0%	3.5%	4.0%	4.5%	5.0%
10 %	Private power supply	60,000 tons	214,813,612				
		120,000 tons	205,958,028				
	Public power supply	60,000 tons	206,459,960				
		120,000 tons	197,604,376				
5 %	Private power supply	60,000 tons	210,526,188	212,229,948	213,933,708		
		120,000 tons	202,118,988	204,430,412	206,685,788		
	Public power supply	60,000 tons	202,172,536	203,876,296	205,580,056	207,283,816	209,043,624
		120,000 tons	193,765,336	195,076,760	196,342,136	197,587,512	198,898,936

As the working capital is one twelfth of the direct production cost, its interest is also constant so long as the direct production cost does not change. As the interest on the depreciation in the eighth column is the same as the monthly interest in the fourth column, it steadily diminishes. The total production costs, which consist of the direct production costs and the indirect costs, such as interests on working capital and depreciation, also monthly decreases in proportion to a steady decrease in the interest on depreciation.

On the other hand, the proceeds of FMP are obtained from a multiplication of the unit price of Rs. 2,700/ton equal to that of SSP and the monthly output of FMP. The government subsidy is obtained by multiplying Rs. 900/ton with the monthly output of FMP. The revenues are the sum of the proceeds and the government subsidy. Finally, the profit and loss are found by subtracting the total production costs from the revenues.

In short, when the ex-factory price of FMP is priced at Rs. 2,700/ton plus a subsidy of Rs. 900/ton like SSP, the manufacturing by private power supply suffers a loss in the initial stage of operation except on the condition of 3 % and 3.5 % of interest rate and 120,000 tons of annual output of phosphate ore. On the other hand, the FMP production relying on public power supply is profitable only for 3 % of interest rate with an annual output of 60,000 tons of phosphorite ore. Further, with all electricity purchased from WAPDA and 120,000 tons of annual output of phosphate ore, manufacturing of FMP can gain a profit from the start of operation at the interest rate below 5 %

Table 40. Profitable pricing of FMP in two cases where a reduced subsidy to fertilizers remains and it is completely abolished.

Interest rate	Subsidized cases with a fixed ex-factory price of Rs. 3,240/ton		Non-subsidized cases with variable ex-factory prices	
	Table number in appendix	Table 22	Table number in appendix	Table 27
3.0%	Term of loan redemption (month)	156	Term of loan redemption (month)	156
	Amount of subsidy (Rs./ton)	126	Ex-factory price (Rs./ton)	3,366
	Final settlement after redemption (Rs.)	87,599,202	Final settlement after redemption (Rs.)	87,599,202
	Total gross margin rate	3.34 %	Total gross margin rate	3.34 %
3.5%	Table number in appendix	Table 23	Table number in appendix	Table 28
	Term of loan redemption (month)	162	Term of loan redemption (month)	162
	Amount of subsidy (Rs./ton)	188	Ex-factory price (Rs./ton)	3,428
	Final settlement after redemption (Rs.)	104,520,207	Final settlement after redemption (Rs.)	104,520,207
4.0%	Table number in appendix	Table 24	Table number in appendix	Table 29
	Term of loan redemption (month)	169	Term of loan redemption (month)	169
	Amount of subsidy (Rs./ton)	248	Ex-factory price (Rs./ton)	3,488
	Final settlement after redemption (Rs.)	122,796,121	Final settlement after redemption (Rs.)	122,796,121
4.5%	Table number in appendix	Table 25	Table number in appendix	Table 30
	Term of loan redemption (month)	177	Term of loan redemption (month)	177
	Amount of subsidy (Rs./ton)	309	Ex-factory price (Rs./ton)	3,549
	Final settlement after redemption (Rs.)	142,448,198	Final settlement after redemption (Rs.)	142,448,198
5.0%	Table number in appendix	Table 26	Table number in appendix	Table 31
	Term of loan redemption (month)	185	Term of loan redemption (month)	185
	Amount of subsidy (Rs./ton)	370	Ex-factory price (Rs./ton)	3,610
	Final settlement after redemption (Rs.)	161,284,377	Final settlement after redemption (Rs.)	161,284,377
	Total gross margin rate	4.90 %	Total gross margin rate	4.90 %

3. Effect of Subsidy Cut on the Pricing of FMP

The Pakistan Government adopts a policy to gradually reduce a subsidy to fertilizers and finally abolish it in the foreseeable future. Table 40 exemplifies two cases where the government subsidy is reduced but remains and it is completely abolished. It is premised that the purchasing prices of phosphorite, magnesite, and quartzite ores include a gross margin of 5 percent only. Furthermore, an annual output of phosphorite ore of 120,000

tons and a total relying of the supplementary energy for manufacturing FMP on the public sector are premised for this estimation.

The left column indicates the prime costs calculated by reckoning the value of soluble silica contained in FMP into its pricing. It shows five cases where the ex-factory price is set at Rs. 3,240/ton that is 20 % higher than that of SSP but the interest rate on the capital costs ranges from 3.0 % to 5.0 %. In any cases, a subsidy ranging from Rs. 126/ton to Rs. 370/ton is required to make the production costs balance with the revenues from the beginning of operation. However, if the subsidy to make the initial production costs balance with the initial revenues is sustained, a total gross margin ranging from 3.34 % to 4.90 % will be secured for each case until the refunding of capital costs is completed. Besides, this table indicates that an increment of 0.5 % of interest rate results in an increase of Rs. 61/ton of the subsidy. Details of the calculation are given in Appendix Tables 22 to 26.

The right column gives five cases where the government subsidy is completely abolished and the interest rate on the capital costs varies between 3.0 % and 5.0 %. With 3 % of interest rate, the prime cost will be Rs. 3,366/ton that is Rs. 666/ton higher than the present ex-factory price of the subsidized SSP. An increment of 0.5 % of interest rate leads to an increase of Rs. 61/ton of the prime cost. The total gross margin secured during the term of redemption ranges from 3.34 % to 4.90 %. Details of the calculation are given in Appendix Tables 27 to 31.

4. Cost Effect of Substituting Fuel Method by Electric Furnace Method

Finally, let study a case where the supply of electricity is improved enough to allow us to adopt an electric furnace method that is cheaper in capital cost and easier in maintenance than the present fuel method. Table 41 gives an approximate estimation of the capital cost and its depreciation required for an electric furnace method. The capital cost and the annual depreciation are estimated at Rs. 359,885,000 and Rs. 32,706,000, respectively. A comparison of production costs of FMP between the present fuel method and an electric furnace method under different interest rates is given in Table 42. The production costs of FMP by the present fuel method are estimated on the preconditions of ore prices including 5 % of gross margin, an annual output of phosphorite ore of 120,000 tons, and the supplementary energy supplied by WAPDA. The estimation of the production costs of FMP by the electric furnace method also employs the same ore prices as the former. Details of the estimation of the production costs are given in Appendix Tables 32 to 37, whilst details of the period of loan refunding, final settlement after loan refunding, and total gross margin rate are given in Appendix Tables from 38 to 42.

Table 41. The estimates of the capital cost and its depreciation for an electric furnace method.

Items	Capital cost (Rs.)	Depreciation period (year)	Annual depreciation (Rs.)
Machinery	283,585,000	10	28,359,000
Vehicles	7,100,000	8	888,000
Buildings	69,200,000	20	3,460,000
Total	359,885,000		32,706,000

Table 42. A comparison of the production costs of FMP between the fuel method and the electric furnace method under different interest rates.

Annual interest rate		3.0 %	3.5 %	4.0 %	4.5 %	5.0 %
Fuel method	Appendix table number	Tab 23	Tab 23	Tab 24	Tab 25	Tab 26
	Period of loan refunding (month)	156	162	169	177	185
	Production cost (Rs./ton)	3,366	3,428	3,488	3,549	3,610
	Final settlement after refunding (Rs.)	87,599,202	104,520,207	142,448,198	128,394,636	161,284,377
	Total gross margin rate (%)	3.34 %	3.78 %	4.59 %	4.32 %	4.90 %
Electric furnace method	Appendix table number	Tab 38	Tab 39	Tab 40	Tab 41	Tab 42
	Period of loan refunding (month)	161	167	175	183	193
	Production cost (Rs./ton)	3,245	3,296	3,347	3,398	3,449
	Final settlement after refunding (Rs.)	67,413,833	80,052,520	94,725,757	109,140,833	125,619,531
	Total gross margin rate (%)	2.56 %	2.90 %	3.23 %	3.52 %	3.79 %

Table 43 shows a comparison of the profitability under the present subsidy system between a fuel method and an electric furnace method. It is premised that the material ores for FMP include a gross margin of 5 %, an annual output of phosphorite is 120,000

tons, and a supplementary energy for a fuel method and the main energy for an electric furnace method are totally supplied by the public sector. This table shows that an electric furnace method can earn an initial gross margin close to twice as large as that of the fuel method.

Table 43. A comparison of the profitability of FMP manufacturing under the present subsidy system to fertilizers between a fuel method and an electric furnace method.

Interest rate	3.0%		3.5%		4.0%		4.5%		5.0%	
Method of manufacturing	Fuel method	Electric method	Fuel method	Electric method	Fuel method	Electric method	Fuel method	Electric method	Fuel method	Electric method
Appendix table number	14	43	17	44	19	45	20	46	21	47
Initial production cost	3,366	3,245	3,428	3,296	3,488	3,347	3,549	3,398	3,610	3,449
Initial gross margin	6.94%	10.94%	5.03%	9.21%	3.20%	7.56%	1.44%	5.95%	-0.28%	4.37%
Total gross margin	10.51%	13.84%	9.00%	12.36%	7.54%	10.92%	6.10%	9.47%	4.61%	7.98%

Table 44 shows a comparison of a minimum subsidy required for FMP manufacturing to make some profit with a 20 % sales price increase by reckoning the fertilizer value of soluble silica in FMP into its pricing between the both methods. It indicates that the electric furnace method can be profitable with a subsidy reduced by more than Rs. 100/ton than that of the fuel method.

Table 44. A comparison of the profitability of FMP manufacturing under the reduced subsidy and a 20 % sales price hike of FMP between a fuel method and an electric furnace method.

Interest rate	3.0%		3.5%		4.0%		4.5%		5.0%	
Method of manufacturing	Fuel method	Electric method	Fuel method	Electric method	Fuel method	Electric method	Fuel method	Electric method	Fuel method	Electric method
Appendix table number	22	48	23	49	24	50	25	51	26	52
Initial production cost	3,366	3,245	3,428	3,296	3,488	3,347	3,549	3,398	3,610	3,449
Initial gross margin	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total gross margin	3.34%	2.56%	3.78%	2.90%	4.20%	3.23%	4.59%	3.52%	4.90%	3.76%
Required subsidy (Rs)	126	5	188	56	248	107	309	158	370	209

CONCLUSION

1. In Pakistan characterized by abundant carbonate rocks and arid climate, alkaline soils, which are rich in calcium and magnesium and range from 7.5 to 8.5 in pH (H₂O), occupy about 80 % of cultivated areas, while the distribution of acidic soils is restricted mainly to the northern part of the country and their acidity is weak.

2. Pakistan ranks low in the international comparison of consumption of chemical fertilizers per unit area. Particularly, 80 % of the soils are deficient in phosphorus, so that domestic production of phosphoric fertilizers should be increased to alleviate the deficiency.

3. Because insoluble silica in the form of quartz and other silicate minerals is ubiquitous in soil, no attention has been paid to the importance of soluble silica, a major constituent of FMP, as a fertilizer in Pakistan. Verification tests on the effectiveness should be conducted to enhance the profitability of production of FMP.

4. Even with a soft loan ranging from 3 to 5 % in interest rate, it is difficult for FMP manufacturing to make a reasonable profit by purchasing material ores including a gross margin of 10 percent. In order for the present fuel method to be profitable, it is required that the annual output of phosphorite be 120,000 tons, the gross margin of material ores be between 5 percent and 7 to 8 percent, and a supplementary energy be totally supplied by the public sector. If the fuel method could be replaced by an electric furnace method thanks to an improvement in electricity supply, the profitability of FMP manufacturing would be drastically improved.

RECOMMENDATIONS

1. Consultations with Pakistani authorities concerned with quality control and marketing of fertilizers:

Since the effectiveness of phosphorus and soluble silica in FMP has not been acknowledged in Pakistan, it is urgently necessary to discuss with the authorities concerned on how to have them recognize FMP as an object for bidding.

2. Implementation of verification tests on the effectiveness of FMP:

For not only making FMP an object for bidding but establishing the market in Pakistan, verification tests on the effectiveness in local soils should be implemented as soon as possible.

3. Proposals for effective verification tests:

It is desirable that tests in several locations be carried out taking account of the following points:

- (1) Selection of phosphorus-deficient farms and paddy fields;
- (2) Selection of crops that consume a lot of soluble silica for the growth like rice, wheat, and sugarcane;
- (3) Application of high-silica FMP (25% SiO₂);
- (4) Application to paddy fields with rampant rice blast to verify the effectiveness of silica in FMP for mitigation of the disease;
- (5) Implementation of the tests by renowned institutes to authorize the results of the study.

4. Application of Japanese-made high-silica FMP:

Since high-silica FMP containing 25% of SiO₂ is produced and consumed in Japan, a Japanese-made high-silica FMP could be used for verification tests.

5. Promotion of concerted efforts by Pakistani authorities concerned:

The Pakistani government, Federal and Provincial, not only has taken various measures for increased production of chemical fertilizers, especially phosphatic one, including active investment and financing, tax reduction, subsidy, and consolidation of infrastructures, but expresses the willingness to further the policy. In addition to such favorable external conditions, a positive result on the cultivation tests by FMP could be also expected. Therefore, it is vitally important for the Pakistani authorities concerned to make concerted efforts for a market research for FMP through the cultivation tests, improvement of infrastructures, and introduction of a further financial and technical cooperation from foreign resources to materialize the ambitious project.

6. Installation of a pilot plant for FMP:

Following verification of the effectiveness of FMP in Pakistan, installation of a pilot plant for FMP is recommendable to acquire the production technique, use the test product of FMP for cultivation tests, and expand the market before a full-fledged production. In this case, an electric furnace is preferable to an open-hearth furnace as a pilot plant. Because the former could be expanded along with an increase in demand, whereas the latter is not suitable for a mini-plant. Furthermore, a soft loan scheme for such a promising pilot plant is available in JICA's technical cooperation list.

Acknowledgments

General information on energy supply in Pakistan was provided by the Ministry of Petroleum and Natural Resources. Information on various privileges granted to a new investment into NWFP is owed to the Industries, Commerce, Mineral Development, Labor and Transport Department, NWFP Provincial Government. Various data needed to estimate the mining costs of phosphate and magnesite ores were given by the Sarhad Development Authority (SDA) and the Pakistan Industrial Development Corporation

(PIDC). Valuable information indispensable to estimate the production costs of FMP is originated from FECTO Cement Co. (Taxila), Mustekham Cement Ltd. (Hattar), Nowshera Sheet Glass Industries, General Ceramic Industries Ltd. (Gujranwala), and EMCO Industries Ltd. (Gujranwala). Information on marketing and pricing of fertilizers in Pakistan was brought by the National Fertilizer Corporation (Haripur) and the National Fertilizer Marketing Ltd. (Lahore). Valuable statistics on production and consumption of fertilizers in Pakistan come from the National Fertilizer Development Corporation (NFDC). Data on soil distribution in Pakistan were obtained at the Soil Survey of Pakistan (Lahore). The authors would like to express our sincere gratitude to the officials concerned of these organizations. Finally, we would like to thank K. Kyotani, an ex-JICA expert stationed in Lahore, for his arrangement for an useful study tour to General Ceramic Industries, a refractory brick manufacturer.

References

- Fused Magnesium Phosphate Manufacturers' Association, 1979, A guidebook to fused magnesium phosphate (in Japanese): A booklet of the association, Tokyo, 118 p.
- Fused Magnesium Phosphate Manufacturers' Association, 1983, A guidebook to fused magnesium phosphate (in Japanese): A booklet of the association, Tokyo, 72 p.
- J. Hirayama and S. Mononobe, 1992, Pakistan is an under-developed treasure land - A Perspective of new exploitation for unused mineral resources around Abbottabad: Proceeding of Geoscience Colloquium, v. 3, p. 28-34.
- Min-Koh International Consultants, 1981, Reserve estimation of the Kumahr magnesite mine: An unpublished report submitted to the Pakistan Industrial Development Corporation (PIDC), 75 P.
- Mononobe, S., Karim, T. and Khan, I. H., 1992a, A preliminary report on a short visit to mineral deposits around Abbottabad, Hazara area: Proceeding of Geoscience Colloquium, v. 3, p. 5-10.
- Mononobe, S., Hirayama, J. and Karim, T., 1992b, A preliminary report on the reserve of Kumahr magnesite mine: Proceeding of Geoscience Colloquium, v. 3, p. 11-22.
- National Fertilizer Development Centre, 1993, Pakistan fertilizer related statistics: NFDC Publication No. 6/93, Statistical Bulletin-6, 120 p.
- N. Okamura, S. Hada, and M. Sato, 1994, A feasibility study on the manufacturing of fused magnesium phosphate in Pakistan (in Japanese): A business report to JICA (unpublished), 51 p.
- Sarhad Development Authority, 1993, Brief report on Hazara phosphate exploration project phase I, II, III, IV and V: NWFP Government (unpublished report), 13 p.

Appendix - Table 1. Monthly accounts of production cost of magnesite (Gross margin of ore=10 %, Interest rate= 3.0 %)

		Invested capital: 36,203,000	Annual interest rate: 3.0 %		Annual output: 24,000 tons		Initial gross margin: 10.00%		Total gross margin: 16.28%			
		Annual depreciation: 3,620,300	Production cost: Rs. 431/ton									
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Shipping cost	Total production costs	Gross margin (10 %)	Revenues	Profit
1	1	36,203,000	90,509	211,184	491,230	1,228	90,508	200,000	782,966	78,297	861,262	78,297
	2	35,991,816	89,980	211,712	491,230	1,228	89,980	200,000	782,438	78,297	861,262	78,825
	3	35,780,104	89,450	212,241	491,230	1,228	89,450	200,000	781,908	78,297	861,262	79,354
	4	35,567,862	88,920	212,772	491,230	1,228	88,920	200,000	781,378	78,297	861,262	79,884
	5	35,353,090	88,388	213,304	491,230	1,228	88,388	200,000	780,846	78,297	861,262	80,416
	6	35,141,786	87,854	213,837	491,230	1,228	87,854	200,000	780,313	78,297	861,262	80,950
	7	34,927,949	87,320	214,372	491,230	1,228	87,320	200,000	779,778	78,297	861,262	81,484
	8	34,711,577	86,784	214,908	491,230	1,228	86,784	200,000	779,242	78,297	861,262	82,020
	9	34,498,670	86,247	215,443	491,230	1,228	86,247	200,000	778,705	78,297	861,262	82,557
	10	34,283,225	85,708	215,984	491,230	1,228	85,708	200,000	778,166	78,297	861,262	83,096
	11	34,067,241	85,168	216,524	491,230	1,228	85,168	200,000	777,626	78,297	861,262	83,636
	12	33,850,717	84,627	217,065	491,230	1,228	84,627	200,000	777,085	78,297	861,262	84,177
2	13	33,633,653	84,084	217,608	491,230	1,228	84,084	200,000	776,542	78,297	861,262	84,720
	14	33,416,045	83,540	218,152	491,230	1,228	83,540	200,000	775,998	78,297	861,262	85,264
	15	33,197,894	82,995	218,697	491,230	1,228	82,995	200,000	775,453	78,297	861,262	85,809
	16	32,979,197	82,448	219,244	491,230	1,228	82,448	200,000	774,906	78,297	861,262	86,356
	17	32,759,951	81,900	219,792	491,230	1,228	81,900	200,000	774,358	78,297	861,262	86,904
	18	32,540,161	81,350	220,341	491,230	1,228	81,350	200,000	773,808	78,297	861,262	87,454
	19	32,319,820	80,800	220,892	491,230	1,228	80,800	200,000	773,258	78,297	861,262	88,005
	20	32,098,928	80,247	221,444	491,230	1,228	80,247	200,000	772,705	78,297	861,262	88,557
	21	31,877,483	79,694	221,998	491,230	1,228	79,694	200,000	772,151	78,297	861,262	89,110
	22	31,655,485	79,139	222,553	491,230	1,228	79,139	200,000	771,597	78,297	861,262	89,665
	23	31,432,932	78,582	223,109	491,230	1,228	78,582	200,000	771,040	78,297	861,262	90,222
	24	31,209,823	78,025	223,667	491,230	1,228	78,025	200,000	770,483	78,297	861,262	90,779
3	25	30,986,156	77,465	224,226	491,230	1,228	77,465	200,000	769,923	78,297	861,262	91,339
	26	30,761,930	76,905	224,787	491,230	1,228	76,905	200,000	769,363	78,297	861,262	91,899
	27	30,537,143	76,343	225,349	491,230	1,228	76,343	200,000	768,801	78,297	861,262	92,461
	28	30,311,794	75,779	225,912	491,230	1,228	75,779	200,000	768,238	78,297	861,262	93,025
	29	30,085,882	75,213	226,477	491,230	1,228	75,213	200,000	767,673	78,297	861,262	93,589
	30	29,859,405	74,649	227,043	491,230	1,228	74,649	200,000	767,107	78,297	861,262	94,156
	31	29,632,362	74,081	227,611	491,230	1,228	74,081	200,000	766,539	78,297	861,262	94,723
	32	29,404,751	73,512	228,180	491,230	1,228	73,512	200,000	765,970	78,297	861,262	95,292
	33	29,176,571	72,941	228,750	491,230	1,228	72,941	200,000	765,400	78,297	861,262	95,863
	34	28,947,821	72,370	229,322	491,230	1,228	72,370	200,000	764,828	78,297	861,262	96,435
	35	28,718,499	71,796	229,895	491,230	1,228	71,796	200,000	764,254	78,297	861,262	97,008
	36	28,488,600	71,222	230,470	491,230	1,228	71,222	200,000	763,680	78,297	861,262	97,583
4	37	28,258,133	70,645	231,046	491,230	1,228	70,645	200,000	763,103	78,297	861,262	98,159
	38	28,027,087	70,068	231,624	491,230	1,228	70,068	200,000	762,526	78,297	861,262	98,736
	39	27,795,463	69,489	232,203	491,230	1,228	69,489	200,000	761,947	78,297	861,262	99,315
	40	27,563,260	68,908	232,784	491,230	1,228	68,908	200,000	761,366	78,297	861,262	99,896
	41	27,330,477	68,326	233,365	491,230	1,228	68,326	200,000	760,784	78,297	861,262	100,478
	42	27,097,111	67,743	233,949	491,230	1,228	67,743	200,000	760,201	78,297	861,262	101,061
	43	26,863,162	67,158	234,534	491,230	1,228	67,158	200,000	759,616	78,297	861,262	101,646
	44	26,628,628	66,572	235,120	491,230	1,228	66,572	200,000	759,030	78,297	861,262	102,232
	45	26,393,508	65,984	235,708	491,230	1,228	65,984	200,000	758,442	78,297	861,262	102,820
	46	26,157,800	65,395	236,297	491,230	1,228	65,395	200,000	757,853	78,297	861,262	103,410
	47	25,921,503	64,804	236,888	491,230	1,228	64,804	200,000	757,262	78,297	861,262	104,000
	48	25,684,615	64,212	237,480	491,230	1,228	64,212	200,000	756,670	78,297	861,262	104,593
5	49	25,447,135	63,618	238,074	491,230	1,228	63,618	200,000	756,076	78,297	861,262	105,186
	50	25,209,061	63,023	238,669	491,230	1,228	63,023	200,000	755,481	78,297	861,262	105,781
	51	24,970,392	62,426	239,266	491,230	1,228	62,426	200,000	754,884	78,297	861,262	106,378
	52	24,731,127	61,828	239,864	491,230	1,228	61,828	200,000	754,286	78,297	861,262	106,976
	53	24,491,263	61,228	240,464	491,230	1,228	61,228	200,000	753,686	78,297	861,262	107,576
	54	24,250,799	60,627	241,065	491,230	1,228	60,627	200,000	753,083	78,297	861,262	108,177
	55	24,009,735	60,024	241,667	491,230	1,228	60,024	200,000	752,482	78,297	861,262	108,780
	56	23,768,067	59,420	242,271	491,230	1,228	59,420	200,000	751,878	78,297	861,262	109,384
	57	23,525,796	58,814	242,877	491,230	1,228	58,814	200,000	751,273	78,297	861,262	109,990
	58	23,282,919	58,207	243,484	491,230	1,228	58,207	200,000	750,665	78,297	861,262	110,597
	59	23,039,434	57,599	244,093	491,230	1,228	57,599	200,000	750,057	78,297	861,262	111,205
	60	22,795,341	56,988	244,703	491,230	1,228	56,988	200,000	749,446	78,297	861,262	111,816
6	61	22,550,638	56,377	245,315	491,230	1,228	56,377	200,000	748,833	78,297	861,262	112,427
	62	22,305,323	55,763	245,928	491,230	1,228	55,763	200,000	748,219	78,297	861,262	113,041
	63	22,059,394	55,148	246,543	491,230	1,228	55,148	200,000	747,607	78,297	861,262	113,656
	64	21,812,851	54,532	247,160	491,230	1,228	54,532	200,000	746,990	78,297	861,262	114,272
	65	21,565,692	53,914	247,777	491,230	1,228	53,914	200,000	746,373	78,297	861,262	114,890
	66	21,317,914	53,295	248,397	491,230	1,228	53,295	200,000	745,753	78,297	861,262	115,509
	67	21,069,517	52,674	249,018	491,230	1,228	52,674	200,000	745,131	78,297	861,262	116,130
	68	20,820,500	52,051	249,640	491,230	1,228	52,051	200,000	744,509	78,297	861,262	116,753
	69	20,570,859	51,427	250,263	491,230	1,228	51,427	200,000	743,885	78,297	861,262	117,377
	70	20,320,595	50,801	250,890	491,230	1,228	50,801	200,000	743,260	78,297	861,262	118,003
	71	20,069,704	50,174	251,517	491,230	1,228	50,174	200,000	742,632	78,297	861,262	118,630
	72	19,818,187	49,545	252,146	491,230	1,228	49,545	200,000	742,001	78,297	861,262	119,259
7	73	19,566,041	48,915	252,777	491,230	1,228	48,915	200,000	741,373	78,297	861,262	119,889
	74	19,313,264	48,283	253,409	491,230	1,228	48,283	200,000	740,741	78,297	861,262	120,521
	75	19,059,856	47,650	254,042	491,230	1,228	47,650	200,000	740,108	78,297	861,262	121,154
	76	18,805,814	47,015	254,677	491,230	1,228	47,015	200,000	739,473	78,297	861,262	121,790
	77	18,551,137	46,378	255,314	491,230	1,228	46,378	200,000	738,836	78,297	861,262	122,426
	78	18,295,823	45,740	255,952	491,230	1,228	45,740	200,000	738,198	78,297	861,262	123,065
	79	18,039,871	45,100	256,592	491,230	1,228	45,100	200,000	737,558	78,297	861,262	123,704
	80	17,783,275	44,458	257,233	491,230	1,228	44,458	200,000	736,916	78,297	861,262	124,346

80	17,783,279	44,458	257,233	491,230	1,228	44,458	200,000	736,916	78,297	861,262	124,346
81	17,526,045	43,815	257,877	491,230	1,228	43,815	200,000	736,273	78,297	861,262	124,989
82	17,268,169	43,170	258,521	491,230	1,228	43,170	200,000	735,628	78,297	861,262	125,634
83	17,009,647	42,524	259,168	491,230	1,228	42,524	200,000	734,982	78,297	861,262	126,280
84	16,750,880	41,876	259,815	491,230	1,228	41,876	200,000	734,334	78,297	861,262	126,928
85	16,490,664	41,227	260,465	491,230	1,228	41,227	200,000	733,685	78,297	861,262	127,577
86	16,230,199	40,575	261,116	491,230	1,228	40,575	200,000	733,034	78,297	861,262	128,229
87	15,969,080	39,923	261,769	491,230	1,228	39,923	200,000	732,381	78,297	861,262	128,881
88	15,707,314	39,268	262,423	491,230	1,228	39,268	200,000	731,726	78,297	861,262	129,536
89	15,444,891	38,612	263,079	491,230	1,228	38,612	200,000	731,070	78,297	861,262	130,192
90	15,181,811	37,955	263,737	491,230	1,228	37,955	200,000	730,413	78,297	861,262	130,850
91	14,918,074	37,295	264,396	491,230	1,228	37,295	200,000	729,753	78,297	861,262	131,509
92	14,653,678	36,634	265,057	491,230	1,228	36,634	200,000	729,092	78,297	861,262	132,170
93	14,388,620	35,972	265,720	491,230	1,228	35,972	200,000	728,430	78,297	861,262	132,833
94	14,122,900	35,307	266,384	491,230	1,228	35,307	200,000	727,765	78,297	861,262	133,497
95	13,856,516	34,641	267,050	491,230	1,228	34,641	200,000	727,099	78,297	861,262	134,163
96	13,589,465	33,974	267,718	491,230	1,228	33,974	200,000	726,432	78,297	861,262	134,830
97	13,321,747	33,304	268,387	491,230	1,228	33,304	200,000	725,762	78,297	861,262	135,500
98	13,053,360	32,633	269,058	491,230	1,228	32,633	200,000	725,091	78,297	861,262	136,171
99	12,784,302	31,961	269,731	491,230	1,228	31,961	200,000	724,419	78,297	861,262	136,843
100	12,514,571	31,286	270,405	491,230	1,228	31,286	200,000	723,745	78,297	861,262	137,518
101	12,244,166	30,610	271,081	491,230	1,228	30,610	200,000	723,068	78,297	861,262	138,194
102	11,973,084	29,933	271,759	491,230	1,228	29,933	200,000	722,391	78,297	861,262	138,871
103	11,701,325	29,253	272,438	491,230	1,228	29,253	200,000	721,711	78,297	861,262	139,551
104	11,428,887	28,572	273,119	491,230	1,228	28,572	200,000	721,030	78,297	861,262	140,232
105	11,155,768	27,889	273,802	491,230	1,228	27,889	200,000	720,347	78,297	861,262	140,915
106	10,881,963	27,205	274,487	491,230	1,228	27,205	200,000	719,663	78,297	861,262	141,599
107	10,607,479	26,519	275,173	491,230	1,228	26,519	200,000	718,977	78,297	861,262	142,285
108	10,332,306	25,831	275,861	491,230	1,228	25,831	200,000	718,289	78,297	861,262	142,973
109	10,056,445	25,141	276,551	491,230	1,228	25,141	200,000	717,599	78,297	861,262	143,663
110	9,779,894	24,450	277,242	491,230	1,228	24,450	200,000	716,908	78,297	861,262	144,354
111	9,502,652	23,757	277,933	491,230	1,228	23,757	200,000	716,215	78,297	861,262	145,047
112	9,224,717	23,062	278,626	491,230	1,228	23,062	200,000	715,520	78,297	861,262	145,742
113	8,946,087	22,365	279,326	491,230	1,228	22,365	200,000	714,823	78,297	861,262	146,439
114	8,666,761	21,667	280,025	491,230	1,228	21,667	200,000	714,125	78,297	861,262	147,137
115	8,386,736	20,967	280,725	491,230	1,228	20,967	200,000	713,425	78,297	861,262	147,837
116	8,106,011	20,265	281,427	491,230	1,228	20,265	200,000	712,723	78,297	861,262	148,539
117	7,824,585	19,561	282,130	491,230	1,228	19,561	200,000	712,020	78,297	861,262	149,243
118	7,542,433	18,856	282,836	491,230	1,228	18,856	200,000	711,314	78,297	861,262	149,948
119	7,259,619	18,149	283,543	491,230	1,228	18,149	200,000	710,607	78,297	861,262	150,655
120	6,976,076	17,440	284,251	491,230	1,228	17,440	200,000	709,898	78,297	861,262	151,364
121	6,691,825	16,730	284,962	491,230	1,228	16,730	200,000	709,188	78,297	861,262	152,074
122	6,406,863	16,017	285,675	491,230	1,228	16,017	200,000	708,475	78,297	861,262	152,787
123	6,121,188	15,303	286,389	491,230	1,228	15,303	200,000	707,761	78,297	861,262	153,501
124	5,834,800	14,587	287,105	491,230	1,228	14,587	200,000	707,045	78,297	861,262	154,217
125	5,547,695	13,869	287,822	491,230	1,228	13,869	200,000	706,327	78,297	861,262	154,935
126	5,259,872	13,151	288,542	491,230	1,228	13,151	200,000	705,608	78,297	861,262	155,654
127	4,971,331	12,431	289,263	491,230	1,228	12,431	200,000	704,886	78,297	861,262	156,376
128	4,682,067	11,705	289,986	491,230	1,228	11,705	200,000	704,163	78,297	861,262	157,099
129	4,392,081	10,980	290,711	491,230	1,228	10,980	200,000	703,438	78,297	861,262	157,824
130	4,101,369	10,253	291,438	491,230	1,228	10,253	200,000	702,711	78,297	861,262	158,551
131	3,809,931	9,525	292,167	491,230	1,228	9,525	200,000	701,983	78,297	861,262	159,279
132	3,517,764	8,794	292,897	491,230	1,228	8,794	200,000	701,252	78,297	861,262	160,010
133	3,224,867	8,062	293,629	491,230	1,228	8,062	200,000	700,520	78,297	861,262	160,742
134	2,931,237	7,328	294,364	491,230	1,228	7,328	200,000	699,786	78,297	861,262	161,476
135	2,636,874	6,592	295,099	491,230	1,228	6,592	200,000	699,050	78,297	861,262	162,212
136	2,341,774	5,854	295,837	491,230	1,228	5,854	200,000	698,313	78,297	861,262	162,950
137	2,045,937	5,115	296,577	491,230	1,228	5,115	200,000	697,573	78,297	861,262	163,689
138	1,749,360	4,373	297,318	491,230	1,228	4,373	200,000	696,831	78,297	861,262	164,431
139	1,452,042	3,630	298,062	491,230	1,228	3,630	200,000	696,088	78,297	861,262	165,174
140	1,153,980	2,885	298,807	491,230	1,228	2,885	200,000	695,343	78,297	861,262	165,919
141	855,174	2,138	299,554	491,230	1,228	2,138	200,000	694,596	78,297	861,262	166,666
142	555,620	1,389	300,303	491,230	1,228	1,389	200,000	693,847	78,297	861,262	167,415
143	255,317	638	301,053	491,230	1,228	638	200,000	693,096	78,297	861,262	168,166
Total		36,203,000	70,243,890	175,615	6,893,172	28,600,000	105,914,677	11,196,408	123,160,485	17,245,808	

Appendix - Table 2 Monthly accounts of production cost of magnesite (Gross margin=5 %, Interest rate= 3.0 %)

Invested capital: 36,203,000		Annual interest rate: 3.0 %		Annual output: 24,000 tons		Initial gross margin: 5.00%						
Annual depreciation: 3,625,306		Production cost: Rs. 411/ton				Total gross margin: 11.00%						
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Shipping cost	Total production costs	Gross margin (5 %)	Revenues	Profit
1	1	36,203,000	90,508	211,184	491,230	1,228	90,508	200,000	782,966	39,148	822,114	39,148
	2	35,991,816	89,980	211,712	491,230	1,228	89,980	200,000	782,438	39,148	822,114	39,676
	3	35,780,104	89,450	212,241	491,230	1,228	89,450	200,000	781,908	39,148	822,114	40,206
	4	35,567,862	88,920	212,772	491,230	1,228	88,920	200,000	781,378	39,148	822,114	40,736
	5	35,355,090	88,388	213,304	491,230	1,228	88,388	200,000	780,846	39,148	822,114	41,268
	6	35,141,786	87,854	213,837	491,230	1,228	87,854	200,000	780,313	39,148	822,114	41,801
	7	34,927,949	87,320	214,372	491,230	1,228	87,320	200,000	779,778	39,148	822,114	42,336
	8	34,713,577	86,784	214,908	491,230	1,228	86,784	200,000	779,242	39,148	822,114	42,872
	9	34,498,670	86,247	215,445	491,230	1,228	86,247	200,000	778,705	39,148	822,114	43,409
	10	34,283,225	85,708	215,984	491,230	1,228	85,708	200,000	778,166	39,148	822,114	43,948
	11	34,067,241	85,168	216,524	491,230	1,228	85,168	200,000	777,626	39,148	822,114	44,489
2	12	33,850,717	84,627	217,065	491,230	1,228	84,627	200,000	777,085	39,148	822,114	45,032
	13	33,633,653	84,084	217,608	491,230	1,228	84,084	200,000	776,542	39,148	822,114	45,577
	14	33,416,045	83,540	218,152	491,230	1,228	83,540	200,000	775,997	39,148	822,114	46,116
	15	33,197,894	82,995	218,697	491,230	1,228	82,995	200,000	775,451	39,148	822,114	46,661
	16	32,979,197	82,448	219,244	491,230	1,228	82,448	200,000	774,906	39,148	822,114	47,208
	17	32,759,953	81,900	219,792	491,230	1,228	81,900	200,000	774,358	39,148	822,114	47,756
	18	32,540,161	81,350	220,341	491,230	1,228	81,350	200,000	773,808	39,148	822,114	48,305
	19	32,319,820	80,800	220,892	491,230	1,228	80,800	200,000	773,258	39,148	822,114	48,856
	20	32,098,928	80,247	221,444	491,230	1,228	80,247	200,000	772,705	39,148	822,114	49,408
	21	31,877,480	79,694	221,998	491,230	1,228	79,694	200,000	772,152	39,148	822,114	49,962
	22	31,655,485	79,139	222,553	491,230	1,228	79,139	200,000	771,597	39,148	822,114	50,517
3	23	31,432,932	78,582	223,109	491,230	1,228	78,582	200,000	771,040	39,148	822,114	51,073
	24	31,209,823	78,025	223,667	491,230	1,228	78,025	200,000	770,483	39,148	822,114	51,631
	25	30,986,156	77,465	224,226	491,230	1,228	77,465	200,000	769,923	39,148	822,114	52,190
	26	30,761,930	76,905	224,787	491,230	1,228	76,905	200,000	769,363	39,148	822,114	52,751
	27	30,537,143	76,343	225,349	491,230	1,228	76,343	200,000	768,801	39,148	822,114	53,313
	28	30,311,794	75,779	225,912	491,230	1,228	75,779	200,000	768,238	39,148	822,114	53,876
	29	30,085,882	75,215	226,477	491,230	1,228	75,215	200,000	767,673	39,148	822,114	54,441
	30	29,859,405	74,649	227,043	491,230	1,228	74,649	200,000	767,107	39,148	822,114	55,007
	31	29,632,362	74,081	227,611	491,230	1,228	74,081	200,000	766,539	39,148	822,114	55,575
	32	29,404,751	73,512	228,180	491,230	1,228	73,512	200,000	765,970	39,148	822,114	56,144
	33	29,176,571	72,941	228,750	491,230	1,228	72,941	200,000	765,400	39,148	822,114	56,714
4	34	28,947,821	72,370	229,322	491,230	1,228	72,370	200,000	764,828	39,148	822,114	57,286
	35	28,718,499	71,796	229,895	491,230	1,228	71,796	200,000	764,254	39,148	822,114	57,860
	36	28,488,603	71,222	230,470	491,230	1,228	71,222	200,000	763,680	39,148	822,114	58,434
	37	28,258,133	70,645	231,046	491,230	1,228	70,645	200,000	763,103	39,148	822,114	59,010
	38	28,027,087	70,068	231,624	491,230	1,228	70,068	200,000	762,526	39,148	822,114	59,588
	39	27,795,463	69,489	232,203	491,230	1,228	69,489	200,000	761,947	39,148	822,114	60,167
	40	27,563,260	68,908	232,784	491,230	1,228	68,908	200,000	761,366	39,148	822,114	60,748
	41	27,330,477	68,326	233,365	491,230	1,228	68,326	200,000	760,784	39,148	822,114	61,330
	42	27,097,111	67,743	233,949	491,230	1,228	67,743	200,000	760,201	39,148	822,114	61,913
	43	26,863,162	67,158	234,534	491,230	1,228	67,158	200,000	759,616	39,148	822,114	62,498
	44	26,628,628	66,572	235,120	491,230	1,228	66,572	200,000	759,030	39,148	822,114	63,084
5	45	26,393,508	65,984	235,708	491,230	1,228	65,984	200,000	758,442	39,148	822,114	63,672
	46	26,157,800	65,395	236,297	491,230	1,228	65,395	200,000	757,853	39,148	822,114	64,261
	47	25,921,503	64,804	236,888	491,230	1,228	64,804	200,000	757,262	39,148	822,114	64,852
	48	25,684,615	64,212	237,480	491,230	1,228	64,212	200,000	756,670	39,148	822,114	65,444
	49	25,447,135	63,618	238,074	491,230	1,228	63,618	200,000	756,076	39,148	822,114	66,038
	50	25,209,061	63,023	238,669	491,230	1,228	63,023	200,000	755,481	39,148	822,114	66,633
	51	24,970,392	62,426	239,266	491,230	1,228	62,426	200,000	754,884	39,148	822,114	67,230
	52	24,731,127	61,828	239,864	491,230	1,228	61,828	200,000	754,286	39,148	822,114	67,828
	53	24,491,263	61,229	240,464	491,230	1,228	61,228	200,000	753,686	39,148	822,114	68,428
	54	24,250,799	60,627	241,065	491,230	1,228	60,627	200,000	753,085	39,148	822,114	69,029
	55	24,009,735	60,024	241,667	491,230	1,228	60,024	200,000	752,482	39,148	822,114	69,631
6	56	23,768,067	59,420	242,271	491,230	1,228	59,420	200,000	751,878	39,148	822,114	70,236
	57	23,525,796	58,814	242,877	491,230	1,228	58,814	200,000	751,273	39,148	822,114	70,841
	58	23,282,919	58,207	243,484	491,230	1,228	58,207	200,000	750,665	39,148	822,114	71,448
	59	23,039,434	57,599	244,093	491,230	1,228	57,599	200,000	750,057	39,148	822,114	72,057
	60	22,795,341	56,988	244,703	491,230	1,228	56,988	200,000	749,446	39,148	822,114	72,667
	61	22,550,638	56,377	245,315	491,230	1,228	56,377	200,000	748,833	39,148	822,114	73,279
	62	22,305,323	55,763	245,928	491,230	1,228	55,763	200,000	748,221	39,148	822,114	73,892
	63	22,059,394	55,148	246,543	491,230	1,228	55,148	200,000	747,607	39,148	822,114	74,507
	64	21,812,851	54,532	247,160	491,230	1,228	54,532	200,000	746,990	39,148	822,114	75,124
	65	21,565,692	53,914	247,777	491,230	1,228	53,914	200,000	746,372	39,148	822,114	75,742
	66	21,317,914	53,295	248,397	491,230	1,228	53,295	200,000	745,753	39,148	822,114	76,361
7	67	21,069,517	52,674	249,018	491,230	1,228	52,674	200,000	745,132	39,148	822,114	76,982
	68	20,820,500	52,051	249,640	491,230	1,228	52,051	200,000	744,509	39,148	822,114	77,605
	69	20,570,859	51,427	250,265	491,230	1,228	51,427	200,000	743,883	39,148	822,114	78,229
	70	20,320,595	50,801	250,890	491,230	1,228	50,801	200,000	743,260	39,148	822,114	78,854
	71	20,069,704	50,174	251,517	491,230	1,228	50,174	200,000	742,632	39,148	822,114	79,482
	72	19,818,187	49,545	252,146	491,230	1,228	49,545	200,000	742,004	39,148	822,114	80,110
	73	19,566,041	48,915	252,777	491,230	1,228	48,915	200,000	741,373	39,148	822,114	80,741
	74	19,313,264	48,283	253,409	491,230	1,228	48,283	200,000	740,741	39,148	822,114	81,373
	75	19,059,856	47,650	254,042	491,230	1,228	47,650	200,000	740,108	39,148	822,114	82,006
	76	18,805,814	47,015	254,677	491,230	1,228	47,015	200,000	739,473	39,148	822,114	82,641
	77	18,551,117	46,378	255,314	491,230	1,228	46,378	200,000	738,836	39,148	822,114	83,278
78	18,295,823	45,740	255,952	491,230	1,228	45,740	200,000	738,198	39,148	822,114	83,916	
79	18,039,871	45,100	256,592	491,230	1,228	45,100	200,000	737,558	39,148	822,114	84,556	

80	17 780 279	44,458	257 233	491 230	1 228	44,458	200,000	736,916	39 148	822,114	85,198
81	17 526 045	43,815	257 877	491 230	1 228	43,815	200,000	736,273	39 148	822,114	85,841
82	17 268 169	43,170	258,521	491 230	1 228	43,170	200,000	735,628	39 148	822,114	86,485
83	17 009 647	42,524	259 168	491 230	1 228	42,524	200,000	734,982	39 148	822,114	87,132
84	16 750 480	41,876	259,815	491 230	1 228	41,876	200,000	734,334	39 148	822,114	87,780
85	16 490 664	41 227	260,463	491 230	1 228	41 227	200,000	733 683	39 148	822,114	88,429
86	16 230 199	40,573	261 116	491 230	1 228	40,573	200,000	733,034	39 148	822,114	89,080
87	15 969 083	39 921	261,769	491 230	1 228	39,923	200,000	732,381	39 148	822,114	89,733
88	15 707 314	39,268	262,423	491 230	1 228	39,268	200,000	731,726	39 148	822,114	90,387
89	15 444 891	38,612	263 079	491 230	1 228	38,612	200,000	731,070	39 148	822,114	91,041
90	15 181 811	37 953	263 737	491 230	1 228	37,953	200,000	730,413	39 148	822,114	91,695
91	14 918 074	37,295	264,396	491 230	1 228	37,295	200,000	729,753	39 148	822,114	92,349
92	14 653 678	36,634	265,057	491 230	1 228	36,634	200,000	729,092	39 148	822,114	93,002
93	14 388 620	35,972	265,720	491 230	1 228	35,972	200,000	728,430	39 148	822,114	93,654
94	14 122 900	35,307	266,384	491 230	1 228	35,307	200,000	727,765	39 148	822,114	94,307
95	13 856 516	34,641	267,050	491 230	1 228	34,641	200,000	727,099	39 148	822,114	94,960
96	13 589 463	33 974	267,718	491 230	1 228	33 974	200,000	726,432	39 148	822,114	95,612
97	13 321 747	33,304	268,387	491 230	1 228	33,304	200,000	725,762	39 148	822,114	96,265
98	13 053 360	32,633	269,058	491 230	1 228	32,633	200,000	725,091	39 148	822,114	96,917
99	12 784 302	31,961	269,731	491 230	1 228	31,961	200,000	724,419	39 148	822,114	97,569
100	12 514 571	31,286	270,403	491 230	1 228	31,286	200,000	723,745	39 148	822,114	98,221
101	12 244 166	30,610	271,081	491 230	1 228	30,610	200,000	723,068	39 148	822,114	98,873
102	11 973 084	29,933	271,759	491 230	1 228	29,933	200,000	722,391	39 148	822,114	99,525
103	11 701 325	29,253	272,438	491 230	1 228	29,253	200,000	721,711	39 148	822,114	100,177
104	11 428 887	28,572	273 119	491 230	1 228	28,572	200,000	721,030	39 148	822,114	100,829
105	11 155 768	27,889	273,802	491 230	1 228	27,889	200,000	720,347	39 148	822,114	101,481
106	10 881 965	27,205	274,487	491 230	1 228	27,205	200,000	719,663	39 148	822,114	102,133
107	10 607 479	26,519	275,173	491 230	1 228	26,519	200,000	718,977	39 148	822,114	102,785
108	10 332 308	25,831	275,861	491 230	1 228	25,831	200,000	718,289	39 148	822,114	103,437
109	10 056 445	25,141	276,551	491 230	1 228	25,141	200,000	717,599	39 148	822,114	104,089
110	9 779 894	24,450	277 242	491 230	1 228	24,450	200,000	716,908	39 148	822,114	104,741
111	9 502 652	23,757	277 935	491 230	1 228	23,757	200,000	716,215	39 148	822,114	105,393
112	9 224 717	23,062	278 630	491 230	1 228	23 062	200,000	715,520	39 148	822,114	106,045
113	8 946 087	22,365	279 326	491 230	1 228	22,365	200,000	714,823	39 148	822,114	106,697
114	8 666 761	21 667	280 025	491 230	1 228	21,667	200,000	714,125	39 148	822,114	107,349
115	8 386 736	20,967	280 725	491 230	1 228	20,967	200,000	713,425	39 148	822,114	108,001
116	8 106 011	20,265	281 427	491 230	1 228	20,265	200,000	712,723	39 148	822,114	108,653
117	7 824 585	19,561	282 130	491 230	1 228	19,561	200,000	712,020	39 148	822,114	109,305
118	7 542 453	18,856	282 836	491 230	1 228	18,856	200,000	711,314	39 148	822,114	109,957
119	7 259 619	18,149	283 543	491 230	1 228	18,149	200,000	710,607	39 148	822,114	110,609
120	6 976 076	17,440	284 251	491 230	1 228	17 440	200,000	709,898	39 148	822,114	111,261
121	6 691 825	16,730	284 962	491 230	1 228	16,730	200,000	709,188	39 148	822,114	111,913
122	6 406 863	16,017	285 675	491 230	1 228	16,017	200,000	708,475	39 148	822,114	112,565
123	6 121 188	15,303	286,389	491 230	1 228	15,303	200,000	707,761	39 148	822,114	113,217
124	5 834 800	14,587	287 105	491 230	1 228	14,587	200,000	707,045	39 148	822,114	113,869
125	5 547 695	13,869	287 822	491 230	1 228	13,869	200,000	706,327	39 148	822,114	114,521
126	5 259 872	13 150	288 542	491 230	1 228	13 150	200,000	705,606	39 148	822,114	115,173
127	4 971 331	12 428	289 263	491 230	1 228	12,428	200,000	704,886	39 148	822,114	115,825
128	4 682 067	11,705	289 986	491 230	1 228	11,705	200,000	704,163	39 148	822,114	116,477
129	4 392 081	10,980	290,711	491 230	1 228	10,980	200,000	703,438	39 148	822,114	117,129
130	4 101 369	10,253	291 438	491 230	1 228	10,253	200,000	702,711	39 148	822,114	117,781
131	3 809 931	9,525	292 167	491 230	1 228	9,525	200,000	701,983	39 148	822,114	118,433
132	3 517 764	8,794	292 897	491 230	1 228	8,794	200,000	701,252	39 148	822,114	119,085
133	3 224 867	8,062	293 629	491 230	1 228	8,062	200,000	700,520	39 148	822,114	119,737
134	2 931 237	7,328	294 364	491 230	1 228	7,328	200,000	699,786	39 148	822,114	120,389
135	2 636 874	6,592	295 099	491 230	1 228	6,592	200,000	699,050	39 148	822,114	121,041
136	2 341 774	5,854	295 837	491 230	1 228	5,854	200,000	698,313	39 148	822,114	121,693
137	2 046 937	5,115	296 577	491 230	1 228	5,115	200,000	697,573	39 148	822,114	122,345
138	1 749 360	4,373	297 318	491 230	1 228	4,373	200,000	696,831	39 148	822,114	123,000
139	1 452 042	3,630	298 062	491 230	1 228	3,630	200,000	696,088	39 148	822,114	123,654
140	1 153 980	2,885	298 807	491 230	1 228	2,885	200,000	695,343	39 148	822,114	124,308
141	855 174	2,138	299 553	491 230	1 228	2,138	200,000	694,596	39 148	822,114	124,962
142	555 620	1,389	300 303	491 230	1 228	1,389	200,000	693,847	39 148	822,114	125,616
143	255 317	638	301 057	491 230	1 228	638	200,000	693,096	39 148	822,114	126,270
Total		36,203,000	70,243,690	175,613	6,893,172	28,600,000	105,914,677	5,598,204	117,562,281	11,647,604	

Appendix - Table 3 Monthly accounts of production cost of phosphoric acid (Gross margin=10 %, Interest rate=3.0 %)

Invested capital: 213,026,000		Annual interest rate: 3.0 %				Annual output: 120,000 tons		Initial gross margin: 10.00 %					
Annual depreciation: 21,302,600		Production cost: R. 1,333/ton						Total gross margin: 13.90 %					
Year	Month	Asset balance	Monthly interest (3 %/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Exploration cost	Shipping cost	Total production costs	Gross margin (10 %)	Revenues	Profit
1	1	213,026,000	512,565	1,242,632	10,396,157	25,990	512,565	165,597	1,000,000	12,120,309	1,212,031	13,332,340	1,212,031
	2	211,781,348	529,458	1,248,758	10,396,157	25,990	529,458	165,597	1,000,000	12,117,202	1,212,031	13,332,340	1,215,138
	3	210,517,970	546,344	1,248,873	10,396,157	25,990	546,344	165,597	1,000,000	12,114,088	1,212,031	13,332,340	1,218,252
	4	209,288,717	563,222	1,251,995	10,396,157	25,990	563,222	165,597	1,000,000	12,110,966	1,212,031	13,332,340	1,221,374
	5	208,076,722	580,092	1,255,125	10,396,157	25,990	580,092	165,597	1,000,000	12,107,836	1,212,031	13,332,340	1,224,504
	6	206,781,598	596,954	1,258,261	10,396,157	25,990	596,954	165,597	1,000,000	12,104,698	1,212,031	13,332,340	1,227,642
	7	205,523,535	613,808	1,261,408	10,396,157	25,990	613,808	165,597	1,000,000	12,101,552	1,212,031	13,332,340	1,230,788
	8	204,261,927	630,655	1,264,562	10,396,157	25,990	630,655	165,597	1,000,000	12,098,399	1,212,031	13,332,340	1,233,941
	9	202,997,365	647,491	1,267,723	10,396,157	25,990	647,491	165,597	1,000,000	12,095,237	1,212,031	13,332,340	1,237,102
	10	201,729,642	664,321	1,270,890	10,396,157	25,990	664,321	165,597	1,000,000	12,092,068	1,212,031	13,332,340	1,240,272
	11	200,458,749	681,147	1,274,070	10,396,157	25,990	681,147	165,597	1,000,000	12,088,891	1,212,031	13,332,340	1,243,449
	12	199,184,679	697,962	1,277,255	10,396,157	25,990	697,962	165,597	1,000,000	12,085,705	1,212,031	13,332,340	1,246,634
2	13	197,907,424	714,769	1,280,448	10,396,157	25,990	714,769	165,597	1,000,000	12,082,512	1,212,031	13,332,340	1,249,827
	14	196,626,976	731,567	1,283,649	10,396,157	25,990	731,567	165,597	1,000,000	12,079,311	1,212,031	13,332,340	1,253,028
	15	195,343,327	748,358	1,286,858	10,396,157	25,990	748,358	165,597	1,000,000	12,076,102	1,212,031	13,332,340	1,256,238
	16	194,056,468	765,141	1,290,075	10,396,157	25,990	765,141	165,597	1,000,000	12,072,885	1,212,031	13,332,340	1,259,455
	17	192,776,193	781,916	1,293,301	10,396,157	25,990	781,916	165,597	1,000,000	12,069,660	1,212,031	13,332,340	1,262,680
	18	191,477,092	798,683	1,296,534	10,396,157	25,990	798,683	165,597	1,000,000	12,066,426	1,212,031	13,332,340	1,265,913
	19	190,176,558	815,441	1,299,775	10,396,157	25,990	815,441	165,597	1,000,000	12,063,185	1,212,031	13,332,340	1,269,154
	20	188,876,783	832,192	1,303,025	10,396,157	25,990	832,192	165,597	1,000,000	12,059,936	1,212,031	13,332,340	1,272,404
	21	187,573,758	848,934	1,306,282	10,396,157	25,990	848,934	165,597	1,000,000	12,056,678	1,212,031	13,332,340	1,275,661
	22	186,267,476	865,669	1,309,548	10,396,157	25,990	865,669	165,597	1,000,000	12,053,412	1,212,031	13,332,340	1,278,927
	23	184,957,928	882,395	1,312,822	10,396,157	25,990	882,395	165,597	1,000,000	12,050,139	1,212,031	13,332,340	1,282,201
	24	183,645,106	899,113	1,316,104	10,396,157	25,990	899,113	165,597	1,000,000	12,046,856	1,212,031	13,332,340	1,285,483
3	25	182,329,020	915,823	1,319,394	10,396,157	25,990	915,823	165,597	1,000,000	12,043,566	1,212,031	13,332,340	1,288,773
	26	181,009,608	932,524	1,322,693	10,396,157	25,990	932,524	165,597	1,000,000	12,040,268	1,212,031	13,332,340	1,292,072
	27	179,686,916	949,217	1,325,999	10,396,157	25,990	949,217	165,597	1,000,000	12,036,961	1,212,031	13,332,340	1,295,379
	28	178,364,916	965,902	1,329,314	10,396,157	25,990	965,902	165,597	1,000,000	12,033,646	1,212,031	13,332,340	1,298,694
	29	177,031,602	982,579	1,332,638	10,396,157	25,990	982,579	165,597	1,000,000	12,030,323	1,212,031	13,332,340	1,302,017
	30	175,698,964	999,247	1,335,969	10,396,157	25,990	999,247	165,597	1,000,000	12,026,991	1,212,031	13,332,340	1,305,348
	31	174,362,795	1,015,907	1,339,309	10,396,157	25,990	1,015,907	165,597	1,000,000	12,023,651	1,212,031	13,332,340	1,308,688
	32	173,023,686	1,032,559	1,342,657	10,396,157	25,990	1,032,559	165,597	1,000,000	12,020,303	1,212,031	13,332,340	1,312,037
	33	171,681,028	1,049,203	1,346,014	10,396,157	25,990	1,049,203	165,597	1,000,000	12,016,946	1,212,031	13,332,340	1,315,393
	34	170,335,014	1,065,838	1,349,379	10,396,157	25,990	1,065,838	165,597	1,000,000	12,013,581	1,212,031	13,332,340	1,318,758
	35	168,985,635	1,082,464	1,352,753	10,396,157	25,990	1,082,464	165,597	1,000,000	12,010,208	1,212,031	13,332,340	1,322,132
	36	167,632,882	1,099,082	1,356,134	10,396,157	25,990	1,099,082	165,597	1,000,000	12,006,826	1,212,031	13,332,340	1,325,514
4	37	166,276,748	1,115,692	1,359,525	10,396,157	25,990	1,115,692	165,597	1,000,000	12,003,436	1,212,031	13,332,340	1,328,904
	38	164,916,223	1,132,293	1,362,929	10,396,157	25,990	1,132,293	165,597	1,000,000	12,000,037	1,212,031	13,332,340	1,332,303
	39	163,554,300	1,148,886	1,366,331	10,396,157	25,990	1,148,886	165,597	1,000,000	11,996,629	1,212,031	13,332,340	1,335,710
	40	162,187,969	1,165,470	1,369,747	10,396,157	25,990	1,165,470	165,597	1,000,000	11,993,214	1,212,031	13,332,340	1,339,126
	41	160,818,222	1,182,046	1,373,171	10,396,157	25,990	1,182,046	165,597	1,000,000	11,989,789	1,212,031	13,332,340	1,342,550
	42	159,445,051	1,198,613	1,376,604	10,396,157	25,990	1,198,613	165,597	1,000,000	11,986,356	1,212,031	13,332,340	1,345,983
	43	158,068,447	1,215,172	1,380,046	10,396,157	25,990	1,215,172	165,597	1,000,000	11,982,915	1,212,031	13,332,340	1,349,425
	44	156,686,401	1,231,727	1,383,496	10,396,157	25,990	1,231,727	165,597	1,000,000	11,979,465	1,212,031	13,332,340	1,352,877
	45	155,300,506	1,248,276	1,386,954	10,396,157	25,990	1,248,276	165,597	1,000,000	11,976,006	1,212,031	13,332,340	1,356,334
	46	153,917,951	1,264,819	1,390,422	10,396,157	25,990	1,264,819	165,597	1,000,000	11,972,539	1,212,031	13,332,340	1,359,801
	47	152,537,320	1,281,357	1,393,899	10,396,157	25,990	1,281,357	165,597	1,000,000	11,969,066	1,212,031	13,332,340	1,363,277
	48	151,153,632	1,297,890	1,397,383	10,396,157	25,990	1,297,890	165,597	1,000,000	11,965,578	1,212,031	13,332,340	1,366,762
5	49	149,768,249	1,314,411	1,400,876	10,396,157	25,990	1,314,411	165,597	1,000,000	11,962,084	1,212,031	13,332,340	1,370,255
	50	148,373,373	1,330,928	1,404,378	10,396,157	25,990	1,330,928	165,597	1,000,000	11,958,582	1,212,031	13,332,340	1,373,757
	51	146,970,999	1,347,441	1,407,889	10,396,157	25,990	1,347,441	165,597	1,000,000	11,955,072	1,212,031	13,332,340	1,377,268
	52	145,523,156	1,363,950	1,411,407	10,396,157	25,990	1,363,950	165,597	1,000,000	11,951,555	1,212,031	13,332,340	1,380,788
	53	144,111,697	1,380,455	1,414,937	10,396,157	25,990	1,380,455	165,597	1,000,000	11,948,032	1,212,031	13,332,340	1,384,317
	54	142,696,759	1,396,956	1,418,467	10,396,157	25,990	1,396,956	165,597	1,000,000	11,944,496	1,212,031	13,332,340	1,387,854
	55	141,278,284	1,413,453	1,422,009	10,396,157	25,990	1,413,453	165,597	1,000,000	11,940,939	1,212,031	13,332,340	1,391,400
	56	139,859,263	1,429,946	1,425,559	10,396,157	25,990	1,429,946	165,597	1,000,000	11,937,341	1,212,031	13,332,340	1,394,955
	57	138,430,697	1,446,435	1,429,110	10,396,157	25,990	1,446,435	165,597	1,000,000	11,933,720	1,212,031	13,332,340	1,398,519
	58	137,001,548	1,462,919	1,432,671	10,396,157	25,990	1,462,919	165,597	1,000,000	11,930,087	1,212,031	13,332,340	1,402,092
	59	135,568,053	1,479,398	1,436,235	10,396,157	25,990	1,479,398	165,597	1,000,000	11,926,442	1,212,031	13,332,340	1,405,674
	60	134,132,546	1,495,872	1,439,802	10,396,157	25,990	1,495,872	165,597	1,000,000	11,922,785	1,212,031	13,332,340	1,409,265
6	61	132,692,655	1,512,341	1,443,375	10,396,157	25,990	1,512,341	165,597	1,000,000	11,919,117	1,212,031	13,332,340	1,412,864
	62	131,249,170	1,528,805	1,447,004	10,396,157	25,990	1,528,805	165,597	1,000,000	11,915,439	1,212,031	13,332,340	1,416,473
	63	129											

80	104,640,519	261,601	1,513,615	10,396,157	25,990	261,601	165,597	1,000,000	11,849,345	1,212,031	13,332,340	1,482,993
81	103,126,904	257,817	1,517,399	10,396,157	25,990	257,817	165,597	1,000,000	11,845,561	1,212,031	13,332,340	1,486,779
82	101,609,504	254,024	1,521,193	10,396,157	25,990	254,024	165,597	1,000,000	11,841,767	1,212,031	13,332,340	1,490,572
83	100,088,312	250,221	1,524,996	10,396,157	25,990	250,221	165,597	1,000,000	11,837,965	1,212,031	13,332,340	1,494,375
84	98,563,316	246,408	1,528,808	10,396,157	25,990	246,408	165,597	1,000,000	11,834,152	1,212,031	13,332,340	1,498,188
85	97,034,507	242,596	1,532,630	10,396,157	25,990	242,596	165,597	1,000,000	11,830,330	1,212,031	13,332,340	1,502,010
86	95,501,877	238,755	1,536,462	10,396,157	25,990	238,755	165,597	1,000,000	11,826,498	1,212,031	13,332,340	1,505,841
87	93,965,415	234,914	1,540,303	10,396,157	25,990	234,914	165,597	1,000,000	11,822,657	1,212,031	13,332,340	1,509,682
88	92,425,112	231,063	1,544,154	10,396,157	25,990	231,063	165,597	1,000,000	11,818,807	1,212,031	13,332,340	1,513,533
89	90,880,958	227,202	1,548,016	10,396,157	25,990	227,202	165,597	1,000,000	11,814,946	1,212,031	13,332,340	1,517,393
90	89,332,944	223,332	1,551,884	10,396,157	25,990	223,332	165,597	1,000,000	11,811,076	1,212,031	13,332,340	1,521,264
91	87,781,059	219,453	1,555,764	10,396,157	25,990	219,453	165,597	1,000,000	11,807,196	1,212,031	13,332,340	1,525,140
92	86,225,295	215,563	1,559,653	10,396,157	25,990	215,563	165,597	1,000,000	11,803,307	1,212,031	13,332,340	1,529,033
93	84,665,642	211,664	1,563,553	10,396,157	25,990	211,664	165,597	1,000,000	11,799,408	1,212,031	13,332,340	1,532,932
94	83,102,089	207,755	1,567,461	10,396,157	25,990	207,755	165,597	1,000,000	11,795,499	1,212,031	13,332,340	1,536,841
95	81,534,628	203,837	1,571,380	10,396,157	25,990	203,837	165,597	1,000,000	11,791,580	1,212,031	13,332,340	1,540,759
96	79,963,248	199,908	1,575,309	10,396,157	25,990	199,908	165,597	1,000,000	11,787,652	1,212,031	13,332,340	1,544,688
97	78,387,939	195,970	1,579,247	10,396,157	25,990	195,970	165,597	1,000,000	11,783,714	1,212,031	13,332,340	1,548,626
98	76,808,692	192,022	1,583,195	10,396,157	25,990	192,022	165,597	1,000,000	11,779,765	1,212,031	13,332,340	1,552,574
99	75,225,497	188,064	1,587,153	10,396,157	25,990	188,064	165,597	1,000,000	11,775,807	1,212,031	13,332,340	1,556,532
100	73,638,345	184,096	1,591,121	10,396,157	25,990	184,096	165,597	1,000,000	11,771,840	1,212,031	13,332,340	1,560,500
101	72,047,224	180,118	1,595,099	10,396,157	25,990	180,118	165,597	1,000,000	11,767,862	1,212,031	13,332,340	1,564,478
102	70,452,125	176,130	1,599,086	10,396,157	25,990	176,130	165,597	1,000,000	11,763,874	1,212,031	13,332,340	1,568,466
103	68,851,039	172,133	1,603,084	10,396,157	25,990	172,133	165,597	1,000,000	11,759,876	1,212,031	13,332,340	1,572,463
104	67,247,955	168,125	1,607,092	10,396,157	25,990	168,125	165,597	1,000,000	11,755,869	1,212,031	13,332,340	1,576,471
105	65,642,863	164,107	1,611,110	10,396,157	25,990	164,107	165,597	1,000,000	11,751,851	1,212,031	13,332,340	1,580,489
106	64,031,753	160,079	1,615,137	10,396,157	25,990	160,079	165,597	1,000,000	11,747,823	1,212,031	13,332,340	1,584,516
107	62,416,616	156,042	1,619,175	10,396,157	25,990	156,042	165,597	1,000,000	11,743,785	1,212,031	13,332,340	1,588,554
108	60,797,441	151,994	1,623,223	10,396,157	25,990	151,994	165,597	1,000,000	11,739,737	1,212,031	13,332,340	1,592,602
109	59,174,218	147,936	1,627,281	10,396,157	25,990	147,936	165,597	1,000,000	11,735,679	1,212,031	13,332,340	1,596,660
110	57,546,937	143,867	1,631,349	10,396,157	25,990	143,867	165,597	1,000,000	11,731,611	1,212,031	13,332,340	1,600,729
111	55,915,587	139,789	1,635,428	10,396,157	25,990	139,789	165,597	1,000,000	11,727,533	1,212,031	13,332,340	1,604,807
112	54,280,160	135,700	1,639,516	10,396,157	25,990	135,700	165,597	1,000,000	11,723,445	1,212,031	13,332,340	1,608,895
113	52,640,644	131,602	1,643,615	10,396,157	25,990	131,602	165,597	1,000,000	11,719,348	1,212,031	13,332,340	1,612,994
114	50,997,028	127,493	1,647,724	10,396,157	25,990	127,493	165,597	1,000,000	11,715,236	1,212,031	13,332,340	1,617,103
115	49,349,304	123,373	1,651,843	10,396,157	25,990	123,373	165,597	1,000,000	11,711,117	1,212,031	13,332,340	1,621,223
116	47,697,461	119,244	1,655,973	10,396,157	25,990	119,244	165,597	1,000,000	11,706,987	1,212,031	13,332,340	1,625,352
117	46,041,488	115,104	1,660,113	10,396,157	25,990	115,104	165,597	1,000,000	11,702,847	1,212,031	13,332,340	1,629,492
118	44,381,375	110,953	1,664,263	10,396,157	25,990	110,953	165,597	1,000,000	11,698,697	1,212,031	13,332,340	1,633,642
119	42,717,112	106,793	1,668,424	10,396,157	25,990	106,793	165,597	1,000,000	11,694,537	1,212,031	13,332,340	1,637,803
120	41,048,688	102,622	1,672,595	10,396,157	25,990	102,622	165,597	1,000,000	11,690,365	1,212,031	13,332,340	1,641,974
121	39,376,093	98,440	1,676,776	10,396,157	25,990	98,440	165,597	1,000,000	11,686,184	1,212,031	13,332,340	1,646,156
122	37,699,316	94,248	1,680,968	10,396,157	25,990	94,248	165,597	1,000,000	11,681,992	1,212,031	13,332,340	1,650,348
123	36,018,348	90,046	1,685,171	10,396,157	25,990	90,046	165,597	1,000,000	11,677,790	1,212,031	13,332,340	1,654,550
124	34,333,177	85,833	1,689,384	10,396,157	25,990	85,833	165,597	1,000,000	11,673,577	1,212,031	13,332,340	1,658,763
125	32,643,794	81,609	1,693,607	10,396,157	25,990	81,609	165,597	1,000,000	11,669,353	1,212,031	13,332,340	1,662,986
126	30,950,186	77,375	1,697,841	10,396,157	25,990	77,375	165,597	1,000,000	11,665,119	1,212,031	13,332,340	1,667,220
127	29,252,345	73,131	1,702,086	10,396,157	25,990	73,131	165,597	1,000,000	11,660,875	1,212,031	13,332,340	1,671,465
128	27,550,259	68,876	1,706,341	10,396,157	25,990	68,876	165,597	1,000,000	11,656,619	1,212,031	13,332,340	1,675,720
129	25,843,918	64,610	1,710,607	10,396,157	25,990	64,610	165,597	1,000,000	11,652,354	1,212,031	13,332,340	1,679,986
130	24,133,312	60,333	1,714,883	10,396,157	25,990	60,333	165,597	1,000,000	11,648,077	1,212,031	13,332,340	1,684,263
131	22,418,428	56,046	1,719,171	10,396,157	25,990	56,046	165,597	1,000,000	11,643,790	1,212,031	13,332,340	1,688,550
132	20,699,258	51,748	1,723,469	10,396,157	25,990	51,748	165,597	1,000,000	11,639,492	1,212,031	13,332,340	1,692,848
133	18,975,789	47,439	1,727,777	10,396,157	25,990	47,439	165,597	1,000,000	11,635,183	1,212,031	13,332,340	1,697,156
134	17,248,012	43,129	1,732,097	10,396,157	25,990	43,129	165,597	1,000,000	11,630,864	1,212,031	13,332,340	1,701,476
135	15,515,915	38,790	1,736,427	10,396,157	25,990	38,790	165,597	1,000,000	11,626,534	1,212,031	13,332,340	1,705,806
136	13,779,488	34,449	1,740,768	10,396,157	25,990	34,449	165,597	1,000,000	11,622,192	1,212,031	13,332,340	1,710,147
137	12,038,720	30,077	1,745,120	10,396,157	25,990	30,077	165,597	1,000,000	11,617,841	1,212,031	13,332,340	1,714,499
138	10,293,600	25,734	1,749,483	10,396,157	25,990	25,734	165,597	1,000,000	11,613,478	1,212,031	13,332,340	1,718,862
139	8,544,118	21,360	1,753,856	10,396,157	25,990	21,360	165,597	1,000,000	11,609,104	1,212,031	13,332,340	1,723,236
140	6,790,261	16,976	1,758,241	10,396,157	25,990	16,976	165,597	1,000,000	11,604,719	1,212,031	13,332,340	1,727,620
141	5,032,020	12,590	1,762,637	10,396,157	25,990	12,590	165,597	1,000,000	11,600,324	1,212,031	13,332,340	1,732,016
142	3,262,384	8,173	1,767,041	10,396,157	25,990	8,173	165,597	1,000,000	11,595,917	1,212,031	13,332,340	1,736,422
143	1,502,341	3,756	1,502,341	10,396,157	25,990	3,756	165,597	1,000,000	11,591,500	1,212,031	13,332,340	1,740,840
Total			213,026,000	1,486,650,403	3,716,626	40,560,853	23,680,323	143,000,000	1,673,927,892	173,320,415	1,906,524,562	232,596,670

Appendix - Table 4 Monthly accounts of production cost of phosphoric (Gross margin=10 %, Interest rate=3.0 %)

Invested capital: 153,561,000			Annual interest rate: 3.0 %			Annual output: 60,000 tons			Initial gross margin: 10.00 %				
Annual depreciation: 15,356,100			Production cost: Rs.1,492/ton						Total gross margin: 14.62 %				
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Exploration cost	Shipping cost	Total production costs	Gross margin (10 %)	Revenues	Profit
1	1	153 561 000	383 903	895 773	5 788 108	14 470	383 903	93 576	500 000	6 780 057	678 006	7 458 063	678 006
	2	152 665 228	381 663	897 012	5 788 108	14 470	381 663	93 576	500 000	6 777 818	678 006	7 458 063	680 235
	3	151 767 216	379 418	900 257	5 788 108	14 470	379 418	93 576	500 000	6 775 571	678 006	7 458 063	682 490
	4	150 866 959	377 167	902 508	5 788 108	14 470	377 167	93 576	500 000	6 773 322	678 006	7 458 063	684 741
	5	149 964 451	374 911	904 764	5 788 108	14 470	374 911	93 576	500 000	6 771 066	678 006	7 458 063	686 997
	6	149 059 687	372 649	907 026	5 788 108	14 470	372 649	93 576	500 000	6 768 804	678 006	7 458 063	689 259
	7	148 152 661	370 382	909 293	5 788 108	14 470	370 382	93 576	500 000	6 766 536	678 006	7 458 063	691 527
	8	147 243 368	368 108	911 567	5 788 108	14 470	368 108	93 576	500 000	6 764 263	678 006	7 458 063	693 790
	9	146 331 801	365 830	913 845	5 788 108	14 470	365 830	93 576	500 000	6 761 984	678 006	7 458 063	696 077
	10	145 417 956	363 545	916 110	5 788 108	14 470	363 545	93 576	500 000	6 759 700	678 006	7 458 063	698 363
	11	144 501 826	361 255	918 420	5 788 108	14 470	361 255	93 576	500 000	6 757 409	678 006	7 458 063	700 654
	12	143 583 405	358 959	920 716	5 788 108	14 470	358 959	93 576	500 000	6 755 113	678 006	7 458 063	702 950
2	13	142 662 689	356 657	923 018	5 788 108	14 470	356 657	93 576	500 000	6 752 811	678 006	7 458 063	705 251
	14	141 739 671	354 349	925 326	5 788 108	14 470	354 349	93 576	500 000	6 750 504	678 006	7 458 063	707 559
	15	140 814 345	352 036	927 639	5 788 108	14 470	352 036	93 576	500 000	6 748 191	678 006	7 458 063	709 872
	16	139 886 706	349 717	929 958	5 788 108	14 470	349 717	93 576	500 000	6 745 871	678 006	7 458 063	712 191
	17	138 956 747	347 392	932 282	5 788 108	14 470	347 392	93 576	500 000	6 743 541	678 006	7 458 063	714 516
	18	138 024 464	345 061	934 614	5 788 108	14 470	345 061	93 576	500 000	6 741 216	678 006	7 458 063	716 847
	19	137 089 850	342 725	936 950	5 788 108	14 470	342 725	93 576	500 000	6 738 879	678 006	7 458 063	719 184
	20	136 152 900	340 382	939 293	5 788 108	14 470	340 382	93 576	500 000	6 736 537	678 006	7 458 063	721 526
	21	135 213 607	338 034	941 641	5 788 108	14 470	338 034	93 576	500 000	6 734 189	678 006	7 458 063	723 874
	22	134 271 966	335 680	943 995	5 788 108	14 470	335 680	93 576	500 000	6 731 835	678 006	7 458 063	726 228
	23	133 327 971	333 320	946 355	5 788 108	14 470	333 320	93 576	500 000	6 729 475	678 006	7 458 063	728 588
	24	132 381 616	330 954	948 721	5 788 108	14 470	330 954	93 576	500 000	6 727 109	678 006	7 458 063	730 954
3	25	131 432 895	328 582	951 093	5 788 108	14 470	328 582	93 576	500 000	6 724 737	678 006	7 458 063	733 326
	26	130 481 802	326 205	953 470	5 788 108	14 470	326 205	93 576	500 000	6 722 359	678 006	7 458 063	735 704
	27	129 528 332	323 821	955 854	5 788 108	14 470	323 821	93 576	500 000	6 719 976	678 006	7 458 063	738 077
	28	128 572 478	321 431	958 244	5 788 108	14 470	321 431	93 576	500 000	6 717 586	678 006	7 458 063	740 477
	29	127 614 234	319 036	960 639	5 788 108	14 470	319 036	93 576	500 000	6 715 190	678 006	7 458 063	742 873
	30	126 653 595	316 634	963 041	5 788 108	14 470	316 634	93 576	500 000	6 712 789	678 006	7 458 063	745 274
	31	125 690 554	314 226	965 449	5 788 108	14 470	314 226	93 576	500 000	6 710 381	678 006	7 458 063	747 682
	32	124 725 105	311 813	967 862	5 788 108	14 470	311 813	93 576	500 000	6 707 967	678 006	7 458 063	750 095
	33	123 757 243	309 393	970 282	5 788 108	14 470	309 393	93 576	500 000	6 705 548	678 006	7 458 063	752 515
	34	122 786 961	306 967	972 708	5 788 108	14 470	306 967	93 576	500 000	6 703 122	678 006	7 458 063	754 941
	35	121 814 253	304 536	975 139	5 788 108	14 470	304 536	93 576	500 000	6 700 690	678 006	7 458 063	757 373
	36	120 839 114	302 098	977 577	5 788 108	14 470	302 098	93 576	500 000	6 698 252	678 006	7 458 063	759 810
4	37	119 861 537	299 654	980 021	5 788 108	14 470	299 654	93 576	500 000	6 695 809	678 006	7 458 063	762 254
	38	118 881 515	297 204	982 471	5 788 108	14 470	297 204	93 576	500 000	6 693 358	678 006	7 458 063	764 703
	39	117 899 044	294 748	984 927	5 788 108	14 470	294 748	93 576	500 000	6 690 902	678 006	7 458 063	767 161
	40	116 914 117	292 285	987 390	5 788 108	14 470	292 285	93 576	500 000	6 688 440	678 006	7 458 063	769 623
	41	115 926 777	289 817	989 856	5 788 108	14 470	289 817	93 576	500 000	6 685 972	678 006	7 458 063	772 091
	42	114 936 869	287 342	992 333	5 788 108	14 470	287 342	93 576	500 000	6 683 501	678 006	7 458 063	774 566
	43	113 944 536	284 861	994 814	5 788 108	14 470	284 861	93 576	500 000	6 681 016	678 006	7 458 063	777 047
	44	112 949 723	282 374	997 301	5 788 108	14 470	282 374	93 576	500 000	6 678 525	678 006	7 458 063	779 534
	45	111 952 422	279 881	999 794	5 788 108	14 470	279 881	93 576	500 000	6 676 036	678 006	7 458 063	782 027
	46	110 952 628	277 382	1 002 293	5 788 108	14 470	277 382	93 576	500 000	6 673 535	678 006	7 458 063	784 527
	47	109 950 334	274 876	1 004 799	5 788 108	14 470	274 876	93 576	500 000	6 671 031	678 006	7 458 063	787 032
	48	108 945 535	272 364	1 007 311	5 788 108	14 470	272 364	93 576	500 000	6 668 519	678 006	7 458 063	789 543
5	49	107 938 234	269 846	1 009 829	5 788 108	14 470	269 846	93 576	500 000	6 666 000	678 006	7 458 063	792 060
	50	106 928 395	267 321	1 012 354	5 788 108	14 470	267 321	93 576	500 000	6 663 476	678 006	7 458 063	794 587
	51	105 916 041	264 790	1 014 885	5 788 108	14 470	264 790	93 576	500 000	6 660 945	678 006	7 458 063	797 118
	52	104 901 156	262 253	1 017 422	5 788 108	14 470	262 253	93 576	500 000	6 658 408	678 006	7 458 063	799 655
	53	103 883 734	259 709	1 019 966	5 788 108	14 470	259 709	93 576	500 000	6 655 864	678 006	7 458 063	802 199
	54	102 863 768	257 159	1 022 516	5 788 108	14 470	257 159	93 576	500 000	6 653 314	678 006	7 458 063	804 749
	55	101 841 252	254 603	1 025 072	5 788 108	14 470	254 603	93 576	500 000	6 650 758	678 006	7 458 063	807 303
	56	100 816 181	252 040	1 027 635	5 788 108	14 470	252 040	93 576	500 000	6 648 195	678 006	7 458 063	809 860
	57	99 788 546	249 471	1 030 204	5 788 108	14 470	249 471	93 576	500 000	6 645 626	678 006	7 458 063	812 437
	58	98 758 342	246 896	1 032 779	5 788 108	14 470	246 896	93 576	500 000	6 643 051	678 006	7 458 063	815 012
	59	97 725 563	244 314	1 035 361	5 788 108	14 470	244 314	93 576	500 000	6 640 469	678 006	7 458 063	817 594
	60	96 690 202	241 726	1 037 949	5 788 108	14 470	241 726	93 576	500 000	6 637 880	678 006	7 458 063	820 183
6	61	95 652 253	239 131	1 040 544	5 788 108	14 470	239 131	93 576	500 000	6 635 285	678 006	7 458 063	822 778
	62	94 611 708	236 529	1 043 146	5 788 108	14 470	236 529	93 576	500 000	6 632 684	678 006	7 458 063	825 379
	63	93 568 563	233 921	1 045 754	5 788 108	14 470	233 921	93 576	500 000	6 630 076	678 006	7 458 063	827 987
	64	92 522 807	231 307	1 048 368	5 788 108	14 470	231 307	93 576	500 000	6 627 462	678 006	7 458 063	830 601
	65	91 474 441	228 686	1 050 989	5 788 108	14 470	228 686	93 576	500 000	6 624 841	678 006	7 458 063	833 222
	66	90 423 452	226 059	1 053 616	5 788 108	14 470	226 059	93 576	500 000	6 622 213	678 006	7 458 063	835 850
	67	89 369 836	223 425	1 056 250	5 788 108	14 470	223 425	93 576	500 000	6 619 579	678 006	7 458 063	838 484
	68	88 313 585	220 784	1 058 891	5 788 108	14 470	220 784	93 576</					

8	80	75,430,712	188,577	1,091,098	5,788,108	14,470	188,577	93,576	500,000	6,584,711	678,006	7,458,063	873,331
	81	74,339,613	185,849	1,093,826	5,788,108	14,470	185,849	93,576	500,000	6,582,004	678,006	7,458,063	876,059
	82	73,245,787	181,114	1,096,561	5,788,108	14,470	181,114	93,576	500,000	6,579,269	678,006	7,458,063	878,794
	83	72,149,227	180,373	1,099,302	5,788,108	14,470	180,373	93,576	500,000	6,576,528	678,006	7,458,063	881,535
	84	71,049,925	177,625	1,102,050	5,788,108	14,470	177,625	93,576	500,000	6,573,779	678,006	7,458,063	884,283
	85	69,947,875	174,870	1,104,805	5,788,108	14,470	174,870	93,576	500,000	6,571,024	678,006	7,458,063	887,039
	86	68,843,069	172,108	1,107,567	5,788,108	14,470	172,108	93,576	500,000	6,568,262	678,006	7,458,063	889,801
	87	67,735,502	169,339	1,110,336	5,788,108	14,470	169,339	93,576	500,000	6,565,493	678,006	7,458,063	892,569
	88	66,625,166	166,563	1,113,112	5,788,108	14,470	166,563	93,576	500,000	6,562,718	678,006	7,458,063	895,345
	89	65,512,054	163,780	1,115,895	5,788,108	14,470	163,780	93,576	500,000	6,559,935	678,006	7,458,063	898,128
9	90	64,396,199	160,970	1,118,645	5,788,108	14,470	160,970	93,576	500,000	6,557,145	678,006	7,458,063	900,918
	91	63,277,474	158,194	1,121,481	5,788,108	14,470	158,194	93,576	500,000	6,554,348	678,006	7,458,063	903,715
	92	62,155,993	155,390	1,124,285	5,788,108	14,470	155,390	93,576	500,000	6,551,545	678,006	7,458,063	906,515
	93	61,031,704	152,579	1,127,096	5,788,108	14,470	152,579	93,576	500,000	6,548,734	678,006	7,458,063	909,319
	94	59,904,612	149,762	1,129,913	5,788,108	14,470	149,762	93,576	500,000	6,545,916	678,006	7,458,063	912,127
	95	58,774,692	146,937	1,132,738	5,788,108	14,470	146,937	93,576	500,000	6,543,091	678,006	7,458,063	914,971
	96	57,641,961	144,105	1,135,570	5,788,108	14,470	144,105	93,576	500,000	6,540,260	678,006	7,458,063	917,823
	97	56,506,390	141,266	1,138,409	5,788,108	14,470	141,266	93,576	500,000	6,537,431	678,006	7,458,063	920,682
	98	55,367,981	138,420	1,141,255	5,788,108	14,470	138,420	93,576	500,000	6,534,575	678,006	7,458,063	923,488
	99	54,226,726	135,567	1,144,108	5,788,108	14,470	135,567	93,576	500,000	6,531,722	678,006	7,458,063	926,311
10	100	53,082,618	132,707	1,146,968	5,788,108	14,470	132,707	93,576	500,000	6,528,861	678,006	7,458,063	929,072
	101	51,935,650	129,839	1,149,836	5,788,108	14,470	129,839	93,576	500,000	6,525,994	678,006	7,458,063	931,869
	102	50,785,814	126,963	1,152,710	5,788,108	14,470	126,963	93,576	500,000	6,523,119	678,006	7,458,063	934,684
	103	49,633,103	124,083	1,155,592	5,788,108	14,470	124,083	93,576	500,000	6,520,237	678,006	7,458,063	937,525
	104	48,477,511	121,194	1,158,481	5,788,108	14,470	121,194	93,576	500,000	6,517,348	678,006	7,458,063	940,314
	105	47,319,030	118,298	1,161,377	5,788,108	14,470	118,298	93,576	500,000	6,514,452	678,006	7,458,063	943,111
	106	46,157,653	115,394	1,164,281	5,788,108	14,470	115,394	93,576	500,000	6,511,549	678,006	7,458,063	945,914
	107	44,993,372	112,483	1,167,192	5,788,108	14,470	112,483	93,576	500,000	6,508,638	678,006	7,458,063	948,723
	108	43,826,180	109,565	1,170,110	5,788,108	14,470	109,565	93,576	500,000	6,505,720	678,006	7,458,063	951,538
	109	42,656,071	106,640	1,173,035	5,788,108	14,470	106,640	93,576	500,000	6,502,795	678,006	7,458,063	954,368
11	110	41,483,036	103,708	1,175,967	5,788,108	14,470	103,708	93,576	500,000	6,499,862	678,006	7,458,063	957,202
	111	40,307,068	100,768	1,178,907	5,788,108	14,470	100,768	93,576	500,000	6,496,922	678,006	7,458,063	960,041
	112	39,128,161	97,820	1,181,855	5,788,108	14,470	97,820	93,576	500,000	6,493,975	678,006	7,458,063	962,885
	113	37,946,306	94,866	1,184,809	5,788,108	14,470	94,866	93,576	500,000	6,491,020	678,006	7,458,063	965,734
	114	36,761,497	91,904	1,187,771	5,788,108	14,470	91,904	93,576	500,000	6,488,058	678,006	7,458,063	968,587
	115	35,573,726	88,934	1,190,744	5,788,108	14,470	88,934	93,576	500,000	6,485,087	678,006	7,458,063	971,445
	116	34,382,985	85,957	1,193,718	5,788,108	14,470	85,957	93,576	500,000	6,482,112	678,006	7,458,063	974,307
	117	33,189,266	82,973	1,196,702	5,788,108	14,470	82,973	93,576	500,000	6,479,128	678,006	7,458,063	977,173
	118	31,992,566	79,981	1,199,694	5,788,108	14,470	79,981	93,576	500,000	6,476,136	678,006	7,458,063	980,043
	119	30,792,872	76,982	1,202,693	5,788,108	14,470	76,982	93,576	500,000	6,473,137	678,006	7,458,063	982,917
12	120	29,590,179	73,975	1,205,700	5,788,108	14,470	73,975	93,576	500,000	6,470,130	678,006	7,458,063	985,795
	121	28,384,480	70,961	1,208,714	5,788,108	14,470	70,961	93,576	500,000	6,467,116	678,006	7,458,063	988,677
	122	27,175,766	67,939	1,211,736	5,788,108	14,470	67,939	93,576	500,000	6,464,094	678,006	7,458,063	991,562
	123	25,964,030	64,910	1,214,765	5,788,108	14,470	64,910	93,576	500,000	6,461,065	678,006	7,458,063	994,450
	124	24,749,266	61,873	1,217,802	5,788,108	14,470	61,873	93,576	500,000	6,458,028	678,006	7,458,063	997,341
	125	23,531,464	58,829	1,220,846	5,788,108	14,470	58,829	93,576	500,000	6,454,983	678,006	7,458,063	1,000,235
	126	22,310,617	55,777	1,223,898	5,788,108	14,470	55,777	93,576	500,000	6,451,931	678,006	7,458,063	1,003,132
	127	21,086,719	52,717	1,226,958	5,788,108	14,470	52,717	93,576	500,000	6,448,871	678,006	7,458,063	1,006,031
	128	19,859,761	49,649	1,230,026	5,788,108	14,470	49,649	93,576	500,000	6,445,804	678,006	7,458,063	1,008,932
	129	18,629,735	46,574	1,233,101	5,788,108	14,470	46,574	93,576	500,000	6,442,729	678,006	7,458,063	1,011,835
13	130	17,396,634	43,492	1,236,183	5,788,108	14,470	43,492	93,576	500,000	6,439,646	678,006	7,458,063	1,014,741
	131	16,160,451	40,401	1,239,274	5,788,108	14,470	40,401	93,576	500,000	6,436,556	678,006	7,458,063	1,017,649
	132	14,921,177	37,303	1,242,372	5,788,108	14,470	37,303	93,576	500,000	6,433,458	678,006	7,458,063	1,020,559
	133	13,678,905	34,197	1,245,478	5,788,108	14,470	34,197	93,576	500,000	6,430,352	678,006	7,458,063	1,023,471
	134	12,433,327	31,083	1,248,592	5,788,108	14,470	31,083	93,576	500,000	6,427,238	678,006	7,458,063	1,026,385
	135	11,184,735	27,962	1,251,713	5,788,108	14,470	27,962	93,576	500,000	6,424,117	678,006	7,458,063	1,029,301
	136	9,933,022	24,833	1,254,842	5,788,108	14,470	24,833	93,576	500,000	6,420,987	678,006	7,458,063	1,032,219
	137	8,678,180	21,695	1,257,980	5,788,108	14,470	21,695	93,576	500,000	6,417,850	678,006	7,458,063	1,035,139
	138	7,420,200	18,551	1,261,124	5,788,108	14,470	18,551	93,576	500,000	6,414,705	678,006	7,458,063	1,038,061
	139	6,159,076	15,398	1,264,277	5,788,108	14,470	15,398	93,576	500,000	6,411,552	678,006	7,458,063	1,040,985
14	140	4,894,798	12,237	1,267,438	5,788,108	14,470	12,237	93,576	500,000	6,408,392	678,006	7,458,063	1,043,911
	141	3,627,540	9,068	1,270,607	5,788,108	14,470	9,068	93,576	500,000	6,405,223	678,006	7,458,063	1,046,839
	142	2,356,754	5,892	1,273,783	5,788,108	14,470	5,892	93,576	500,000	6,402,047	678,006	7,458,063	1,049,769
	143	1,082,971	2,707	1,276,971	5,788,108	14,470	2,707	93,576	500,000	6,398,862	678,006	7,458,063	1,052,701
	Total		153,561,000	827,699,492	2,069,249	2,238,528	13,381,380	71,500,000	910,507,269	96,954,814	1,074,502,976	13,915,727	

Appendix - Table 5. Monthly accounts of production cost of phosphoric (Gross margins 5%, Interest rate=3.0%)

Invested capital: 213,026,000				Annual interest rate: 3.0 %				Annual output: 120,000 tons				Initial gross margin rate: 5.00%			
Annual depreciation: 21,302,600				Price of ore: Rs. 1,273/ton								Total gross margin rate: 8.72 %			
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Explosion cost	Shipping cost	Total production costs	Gross margin (5 %)	Revenue	Profit		
1	1	213,026,000	532,565	1,242,652	10,396,157	24,990	532,565	165,597	1,000,000	12,120,367	606,018	12,726,384	606,018		
	2	211,783,348	529,458	1,245,756	10,396,157	25,000	529,458	165,597	1,000,000	12,117,207	606,018	12,726,324	609,122		
	3	210,537,900	526,344	1,248,871	10,396,157	25,000	526,344	165,597	1,000,000	12,114,038	606,018	12,726,324	612,236		
	4	209,288,717	523,237	1,251,995	10,396,157	25,000	523,237	165,597	1,000,000	12,110,866	606,018	12,726,324	615,350		
	5	208,036,732	520,092	1,255,125	10,396,157	25,000	520,092	165,597	1,000,000	12,107,693	606,018	12,726,324	618,464		
	6	206,781,598	516,944	1,258,263	10,396,157	25,000	516,944	165,597	1,000,000	12,104,498	606,018	12,726,324	621,578		
	7	205,523,333	513,808	1,261,408	10,396,157	25,000	513,808	165,597	1,000,000	12,101,312	606,018	12,726,324	624,692		
	8	204,261,927	510,655	1,264,562	10,396,157	25,000	510,655	165,597	1,000,000	12,098,139	606,018	12,726,324	627,806		
	9	202,997,365	507,493	1,267,723	10,396,157	25,000	507,493	165,597	1,000,000	12,095,237	606,018	12,726,324	631,007		
	10	201,729,642	504,324	1,270,911	10,396,157	25,000	504,324	165,597	1,000,000	12,092,068	606,018	12,726,324	634,250		
	11	200,458,749	501,147	1,274,070	10,396,157	25,000	501,147	165,597	1,000,000	12,088,891	606,018	12,726,324	637,434		
	12	199,184,679	497,962	1,277,255	10,396,157	25,000	497,962	165,597	1,000,000	12,085,705	606,018	12,726,324	640,619		
2	13	197,907,424	494,769	1,280,448	10,396,157	25,000	494,769	165,597	1,000,000	12,082,512	606,018	12,726,324	643,812		
	14	196,626,976	491,567	1,283,649	10,396,157	25,000	491,567	165,597	1,000,000	12,079,311	606,018	12,726,324	647,013		
	15	195,343,327	488,358	1,286,858	10,396,157	25,000	488,358	165,597	1,000,000	12,076,102	606,018	12,726,324	650,223		
	16	194,056,468	485,141	1,290,075	10,396,157	25,000	485,141	165,597	1,000,000	12,072,885	606,018	12,726,324	653,439		
	17	192,766,393	481,916	1,293,301	10,396,157	25,000	481,916	165,597	1,000,000	12,069,660	606,018	12,726,324	656,664		
	18	191,473,092	478,683	1,296,534	10,396,157	25,000	478,683	165,597	1,000,000	12,066,426	606,018	12,726,324	659,898		
	19	190,176,538	475,441	1,299,775	10,396,157	25,000	475,441	165,597	1,000,000	12,063,185	606,018	12,726,324	663,139		
	20	188,876,783	472,192	1,303,023	10,396,157	25,000	472,192	165,597	1,000,000	12,059,936	606,018	12,726,324	666,388		
	21	187,573,758	468,934	1,306,281	10,396,157	25,000	468,934	165,597	1,000,000	12,056,678	606,018	12,726,324	669,646		
	22	186,267,476	465,669	1,309,543	10,396,157	25,000	465,669	165,597	1,000,000	12,053,412	606,018	12,726,324	672,912		
	23	184,957,928	462,395	1,312,822	10,396,157	25,000	462,395	165,597	1,000,000	12,050,139	606,018	12,726,324	676,186		
	24	183,645,106	459,113	1,316,106	10,396,157	25,000	459,113	165,597	1,000,000	12,046,866	606,018	12,726,324	679,468		
3	25	182,329,002	455,823	1,319,394	10,396,157	25,000	455,823	165,597	1,000,000	12,043,586	606,018	12,726,324	682,758		
	26	181,009,608	452,524	1,322,693	10,396,157	25,000	452,524	165,597	1,000,000	12,040,298	606,018	12,726,324	686,056		
	27	179,686,918	449,217	1,325,999	10,396,157	25,000	449,217	165,597	1,000,000	12,036,991	606,018	12,726,324	689,363		
	28	178,360,916	445,902	1,329,314	10,396,157	25,000	445,902	165,597	1,000,000	12,033,666	606,018	12,726,324	692,678		
	29	177,031,602	442,579	1,332,638	10,396,157	25,000	442,579	165,597	1,000,000	12,030,333	606,018	12,726,324	696,001		
	30	175,698,964	439,247	1,335,969	10,396,157	25,000	439,247	165,597	1,000,000	12,026,991	606,018	12,726,324	699,333		
	31	174,362,993	435,907	1,339,309	10,396,157	25,000	435,907	165,597	1,000,000	12,023,651	606,018	12,726,324	702,673		
	32	173,023,686	432,559	1,342,657	10,396,157	25,000	432,559	165,597	1,000,000	12,020,303	606,018	12,726,324	706,021		
	33	171,681,028	429,203	1,346,014	10,396,157	25,000	429,203	165,597	1,000,000	12,016,946	606,018	12,726,324	709,378		
	34	170,335,014	425,838	1,349,379	10,396,157	25,000	425,838	165,597	1,000,000	12,013,581	606,018	12,726,324	712,743		
	35	168,985,635	422,464	1,352,753	10,396,157	25,000	422,464	165,597	1,000,000	12,010,208	606,018	12,726,324	716,116		
	36	167,632,882	419,082	1,356,134	10,396,157	25,000	419,082	165,597	1,000,000	12,006,826	606,018	12,726,324	719,498		
4	37	166,276,748	415,692	1,359,525	10,396,157	25,000	415,692	165,597	1,000,000	12,003,436	606,018	12,726,324	722,889		
	38	164,917,223	412,293	1,362,929	10,396,157	25,000	412,293	165,597	1,000,000	12,000,037	606,018	12,726,324	726,287		
	39	163,554,300	408,886	1,366,331	10,396,157	25,000	408,886	165,597	1,000,000	11,996,629	606,018	12,726,324	729,693		
	40	162,187,969	405,470	1,369,747	10,396,157	25,000	405,470	165,597	1,000,000	11,993,214	606,018	12,726,324	733,111		
	41	160,818,223	402,046	1,373,171	10,396,157	25,000	402,046	165,597	1,000,000	11,989,789	606,018	12,726,324	736,535		
	42	159,445,051	398,613	1,376,604	10,396,157	25,000	398,613	165,597	1,000,000	11,986,356	606,018	12,726,324	739,968		
	43	158,068,447	395,171	1,380,046	10,396,157	25,000	395,171	165,597	1,000,000	11,982,913	606,018	12,726,324	743,409		
	44	156,688,401	391,721	1,383,496	10,396,157	25,000	391,721	165,597	1,000,000	11,979,468	606,018	12,726,324	746,859		
	45	155,304,906	388,262	1,386,954	10,396,157	25,000	388,262	165,597	1,000,000	11,976,003	606,018	12,726,324	750,318		
	46	153,917,951	384,795	1,390,427	10,396,157	25,000	384,795	165,597	1,000,000	11,972,539	606,018	12,726,324	753,786		
	47	152,527,529	381,319	1,393,898	10,396,157	25,000	381,319	165,597	1,000,000	11,969,065	606,018	12,726,324	757,262		
	48	151,133,632	377,834	1,397,383	10,396,157	25,000	377,834	165,597	1,000,000	11,965,578	606,018	12,726,324	760,746		
5	49	149,736,249	374,341	1,400,876	10,396,157	25,000	374,341	165,597	1,000,000	11,962,084	606,018	12,726,324	764,240		
	50	148,335,373	370,838	1,404,378	10,396,157	25,000	370,838	165,597	1,000,000	11,958,582	606,018	12,726,324	767,742		
	51	146,930,993	367,327	1,407,889	10,396,157	25,000	367,327	165,597	1,000,000	11,955,071	606,018	12,726,324	771,253		
	52	145,523,106	363,808	1,411,409	10,396,157	25,000	363,808	165,597	1,000,000	11,951,551	606,018	12,726,324	774,773		
	53	144,111,697	360,279	1,414,937	10,396,157	25,000	360,279	165,597	1,000,000	11,948,023	606,018	12,726,324	778,301		
	54	142,696,179	356,742	1,418,475	10,396,157	25,000	356,742	165,597	1,000,000	11,944,486	606,018	12,726,324	781,839		
	55	141,278,284	353,198	1,422,021	10,396,157	25,000	353,198	165,597	1,000,000	11,940,939	606,018	12,726,324	785,383		
	56	139,858,263	349,641	1,425,576	10,396,157	25,000	349,641	165,597	1,000,000	11,937,384	606,018	12,726,324	788,940		
	57	138,436,687	346,077	1,429,140	10,396,157	25,000	346,077	165,597	1,000,000	11,933,820	606,018	12,726,324	792,504		
	58	137,001,548	342,504	1,432,713	10,396,157	25,000	342,504	165,597	1,000,000	11,930,248	606,018	12,726,324	796,077		
	59	135,566,834	338,922	1,436,295	10,396,157	25,000	338,922	165,597	1,000,000	11,926,666	606,018	12,726,324	799,658		
	60	134,132,540	335,331	1,439,885	10,396,157	25,000	335,331	165,597	1,000,000	11,923,073	606,018	12,726,324	803,249		
6	61	132,692,655	331,732	1,443,485	10,396,157	25,000	331,732	165,597	1,000,000	11,919,473	606,018	12,726,324	806,849		
	62	131,249,170	328,123	1,447,094	10,396,157	25,000	328,123	165,597	1,000,000	11,915,867	606,018	12,726,324	810,458		
	63	129,802,076	324,505	1,450,711	10,396,157	25,000	324,505	165,597	1,000,000	11,912,249	606,018	12,726,324	814,075		
	64	128,351,365	320,878	1,454,338	10,396,157	25,000	320,878	165,597	1,000,000	11,908,622	606,018	12,726,324	817,702		
	65	126,897,026	317,243	1,457,974	10,396,157	25,000	317,243	165,597	1,000,000	11,904,986	606,				

80	104 640 519	261 601	1 513 613	10 396 157	25 990	261 601	165 997	1 000 000	11 849 345	606 015	12 726 324	876 979	
81	103 126 904	257 817	1 517 399	10 396 157	25 990	257 817	165 997	1 000 000	11 845 561	606 015	12 726 324	880 763	
82	101 609 504	254 024	1 521 193	10 396 157	25 990	254 024	165 997	1 000 000	11 841 767	606 015	12 726 324	884 557	
83	100 088 312	250 221	1 524 996	10 396 157	25 990	250 221	165 997	1 000 000	11 837 965	606 015	12 726 324	888 360	
84	98 563 316	246 408	1 528 808	10 396 157	25 990	246 408	165 997	1 000 000	11 834 152	606 015	12 726 324	892 172	
85	97 034 507	242 586	1 532 630	10 396 157	25 990	242 586	165 997	1 000 000	11 830 330	606 015	12 726 324	895 994	
86	95 501 877	238 755	1 536 462	10 396 157	25 990	238 755	165 997	1 000 000	11 826 498	606 015	12 726 324	899 826	
87	93 965 415	234 914	1 540 303	10 396 157	25 990	234 914	165 997	1 000 000	11 822 657	606 015	12 726 324	903 667	
88	92 425 112	231 063	1 544 154	10 396 157	25 990	231 063	165 997	1 000 000	11 818 807	606 015	12 726 324	907 518	
89	90 880 598	227 202	1 548 014	10 396 157	25 990	227 202	165 997	1 000 000	11 814 946	606 015	12 726 324	911 378	
90	89 332 944	223 332	1 551 884	10 396 157	25 990	223 332	165 997	1 000 000	11 811 076	606 015	12 726 324	915 248	
91	87 781 059	219 453	1 555 764	10 396 157	25 990	219 453	165 997	1 000 000	11 807 196	606 015	12 726 324	919 128	
92	86 225 295	215 563	1 559 653	10 396 157	25 990	215 563	165 997	1 000 000	11 803 307	606 015	12 726 324	923 017	
93	84 665 642	211 664	1 563 553	10 396 157	25 990	211 664	165 997	1 000 000	11 799 408	606 015	12 726 324	926 916	
94	83 102 089	207 755	1 567 461	10 396 157	25 990	207 755	165 997	1 000 000	11 795 499	606 015	12 726 324	930 825	
95	81 534 624	203 837	1 571 380	10 396 157	25 990	203 837	165 997	1 000 000	11 791 580	606 015	12 726 324	934 744	
96	79 963 248	199 908	1 575 309	10 396 157	25 990	199 908	165 997	1 000 000	11 787 652	606 015	12 726 324	938 672	
97	78 387 939	195 970	1 579 247	10 396 157	25 990	195 970	165 997	1 000 000	11 783 714	606 015	12 726 324	942 611	
98	76 808 692	192 022	1 583 195	10 396 157	25 990	192 022	165 997	1 000 000	11 779 765	606 015	12 726 324	946 559	
99	75 225 497	188 064	1 587 153	10 396 157	25 990	188 064	165 997	1 000 000	11 775 807	606 015	12 726 324	950 517	
100	73 638 345	184 096	1 591 121	10 396 157	25 990	184 096	165 997	1 000 000	11 771 840	606 015	12 726 324	954 485	
101	72 047 224	180 118	1 595 099	10 396 157	25 990	180 118	165 997	1 000 000	11 767 862	606 015	12 726 324	958 462	
102	70 452 125	176 130	1 599 086	10 396 157	25 990	176 130	165 997	1 000 000	11 763 874	606 015	12 726 324	962 450	
103	68 853 039	172 133	1 603 084	10 396 157	25 990	172 133	165 997	1 000 000	11 759 876	606 015	12 726 324	966 448	
104	67 249 955	168 125	1 607 092	10 396 157	25 990	168 125	165 997	1 000 000	11 755 869	606 015	12 726 324	970 456	
105	65 642 863	164 107	1 611 110	10 396 157	25 990	164 107	165 997	1 000 000	11 751 851	606 015	12 726 324	974 473	
106	64 031 753	160 079	1 615 137	10 396 157	25 990	160 079	165 997	1 000 000	11 747 823	606 015	12 726 324	978 501	
107	62 416 616	156 042	1 619 175	10 396 157	25 990	156 042	165 997	1 000 000	11 743 785	606 015	12 726 324	982 539	
108	60 797 441	151 994	1 623 223	10 396 157	25 990	151 994	165 997	1 000 000	11 739 737	606 015	12 726 324	986 587	
109	59 174 218	147 936	1 627 281	10 396 157	25 990	147 936	165 997	1 000 000	11 735 679	606 015	12 726 324	990 645	
110	57 546 937	143 867	1 631 349	10 396 157	25 990	143 867	165 997	1 000 000	11 731 611	606 015	12 726 324	994 713	
111	55 915 597	139 789	1 635 428	10 396 157	25 990	139 789	165 997	1 000 000	11 727 533	606 015	12 726 324	998 791	
112	54 280 160	135 700	1 639 516	10 396 157	25 990	135 700	165 997	1 000 000	11 723 444	606 015	12 726 324	1 002 880	
113	52 640 644	131 602	1 643 613	10 396 157	25 990	131 602	165 997	1 000 000	11 719 345	606 015	12 726 324	1 006 979	
114	50 997 028	127 493	1 647 724	10 396 157	25 990	127 493	165 997	1 000 000	11 715 236	606 015	12 726 324	1 011 088	
115	49 349 304	123 373	1 651 843	10 396 157	25 990	123 373	165 997	1 000 000	11 711 117	606 015	12 726 324	1 015 207	
116	47 697 461	119 244	1 655 973	10 396 157	25 990	119 244	165 997	1 000 000	11 706 987	606 015	12 726 324	1 019 337	
117	46 041 488	115 104	1 660 113	10 396 157	25 990	115 104	165 997	1 000 000	11 702 847	606 015	12 726 324	1 023 477	
118	44 381 375	110 953	1 664 263	10 396 157	25 990	110 953	165 997	1 000 000	11 698 697	606 015	12 726 324	1 027 627	
119	42 717 112	106 793	1 668 424	10 396 157	25 990	106 793	165 997	1 000 000	11 694 537	606 015	12 726 324	1 031 788	
120	41 048 688	102 622	1 672 595	10 396 157	25 990	102 622	165 997	1 000 000	11 690 365	606 015	12 726 324	1 035 959	
121	39 376 059	98 440	1 676 776	10 396 157	25 990	98 440	165 997	1 000 000	11 686 184	606 015	12 726 324	1 040 140	
122	37 699 316	94 248	1 680 968	10 396 157	25 990	94 248	165 997	1 000 000	11 681 972	606 015	12 726 324	1 044 332	
123	36 018 348	90 046	1 685 171	10 396 157	25 990	90 046	165 997	1 000 000	11 677 750	606 015	12 726 324	1 048 535	
124	34 333 177	85 833	1 689 384	10 396 157	25 990	85 833	165 997	1 000 000	11 673 517	606 015	12 726 324	1 052 747	
125	32 643 794	81 609	1 693 607	10 396 157	25 990	81 609	165 997	1 000 000	11 669 273	606 015	12 726 324	1 056 971	
126	30 950 186	77 373	1 697 841	10 396 157	25 990	77 373	165 997	1 000 000	11 665 019	606 015	12 726 324	1 061 205	
127	29 252 345	73 131	1 702 086	10 396 157	25 990	73 131	165 997	1 000 000	11 660 755	606 015	12 726 324	1 065 450	
128	27 550 239	68 876	1 706 341	10 396 157	25 990	68 876	165 997	1 000 000	11 656 481	606 015	12 726 324	1 069 705	
129	25 843 918	64 610	1 710 607	10 396 157	25 990	64 610	165 997	1 000 000	11 652 196	606 015	12 726 324	1 073 971	
130	24 133 312	60 333	1 714 880	10 396 157	25 990	60 333	165 997	1 000 000	11 647 907	606 015	12 726 324	1 078 247	
131	22 418 428	56 046	1 719 171	10 396 157	25 990	56 046	165 997	1 000 000	11 643 700	606 015	12 726 324	1 082 534	
132	20 699 258	51 748	1 723 469	10 396 157	25 990	51 748	165 997	1 000 000	11 639 483	606 015	12 726 324	1 086 832	
133	18 975 789	47 439	1 727 777	10 396 157	25 990	47 439	165 997	1 000 000	11 635 255	606 015	12 726 324	1 091 141	
134	17 248 012	43 120	1 732 097	10 396 157	25 990	43 120	165 997	1 000 000	11 631 016	606 015	12 726 324	1 095 460	
135	15 515 915	38 799	1 736 427	10 396 157	25 990	38 799	165 997	1 000 000	11 626 764	606 015	12 726 324	1 099 791	
136	13 779 488	34 449	1 740 768	10 396 157	25 990	34 449	165 997	1 000 000	11 622 499	606 015	12 726 324	1 104 132	
137	12 038 720	30 097	1 745 120	10 396 157	25 990	30 097	165 997	1 000 000	11 618 221	606 015	12 726 324	1 108 484	
138	10 293 600	25 734	1 749 483	10 396 157	25 990	25 734	165 997	1 000 000	11 613 938	606 015	12 726 324	1 112 846	
139	8 544 118	21 360	1 753 856	10 396 157	25 990	21 360	165 997	1 000 000	11 609 649	606 015	12 726 324	1 117 220	
140	6 790 261	16 976	1 758 241	10 396 157	25 990	16 976	165 997	1 000 000	11 605 354	606 015	12 726 324	1 121 605	
141	5 032 020	12 590	1 762 637	10 396 157	25 990	12 590	165 997	1 000 000	11 601 054	606 015	12 726 324	1 126 000	
142	3 269 384	8 173	1 767 043	10 396 157	25 990	8 173	165 997	1 000 000	11 596 747	606 015	12 726 324	1 130 407	
143	1 502 341	3 756	1 502 341	10 396 157	25 990	3 756	165 997	1 000 000	11 591 500	606 015	12 726 324	1 134 825	
Total				213 026 000	1 486 650 430	3 716 626	40 560 863	23 680 323	1 433 000 000	1 673 927 872	86 660 207	1 819 864 355	145 936 463

Appendix - 7 table 6 Monthly accounts of production cost of phosphoric (Gross margin= 5%, Interest rate= 3.0 %)

Invested capital: 153,561,000		Annual interest rate: 3.0 %		Annual output: 60,300 tons		Initial gross margin: 5.00 %							
Annual depreciation: 15,356,100		Price of ore: Rs. 1,424/ton				Total gross margin: 9.14 %							
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Exploration cost	Shipping cost	Total production costs	Gross margin (5%)	Revenues	Profit
1	1	153,561,000	383,903	895,773	5,788,108	14,470	383,903	93,576	500,000	6,780,057	339,003	7,119,060	339,003
	2	152,665,228	381,663	898,012	5,788,108	14,470	381,663	93,576	500,000	6,777,818	339,003	7,119,060	341,242
	3	151,767,216	379,418	900,257	5,788,108	14,470	379,418	93,576	500,000	6,775,573	339,003	7,119,060	343,487
	4	150,866,959	377,167	902,508	5,788,108	14,470	377,167	93,576	500,000	6,773,322	339,003	7,119,060	345,738
	5	149,964,451	374,911	904,764	5,788,108	14,470	374,911	93,576	500,000	6,771,066	339,003	7,119,060	347,994
	6	149,059,687	372,649	907,026	5,788,108	14,470	372,649	93,576	500,000	6,768,804	339,003	7,119,060	350,256
	7	148,152,661	370,382	909,293	5,788,108	14,470	370,382	93,576	500,000	6,766,536	339,003	7,119,060	352,524
	8	147,243,368	368,108	911,567	5,788,108	14,470	368,108	93,576	500,000	6,764,263	339,003	7,119,060	354,797
	9	146,331,801	365,830	913,845	5,788,108	14,470	365,830	93,576	500,000	6,761,984	339,003	7,119,060	357,076
	10	145,417,956	363,545	916,130	5,788,108	14,470	363,545	93,576	500,000	6,759,700	339,003	7,119,060	359,360
	11	144,501,826	361,255	918,420	5,788,108	14,470	361,255	93,576	500,000	6,757,409	339,003	7,119,060	361,651
	12	143,583,405	358,959	920,716	5,788,108	14,470	358,959	93,576	500,000	6,755,113	339,003	7,119,060	363,947
2	13	142,662,689	356,657	923,018	5,788,108	14,470	356,657	93,576	500,000	6,752,811	339,003	7,119,060	366,249
	14	141,739,671	354,349	925,326	5,788,108	14,470	354,349	93,576	500,000	6,750,504	339,003	7,119,060	368,556
	15	140,814,345	352,036	927,639	5,788,108	14,470	352,036	93,576	500,000	6,748,191	339,003	7,119,060	370,869
	16	139,886,706	349,717	929,958	5,788,108	14,470	349,717	93,576	500,000	6,745,871	339,003	7,119,060	373,189
	17	138,956,747	347,392	932,283	5,788,108	14,470	347,392	93,576	500,000	6,743,547	339,003	7,119,060	375,513
	18	138,024,464	345,061	934,614	5,788,108	14,470	345,061	93,576	500,000	6,741,216	339,003	7,119,060	377,844
	19	137,089,850	342,725	936,950	5,788,108	14,470	342,725	93,576	500,000	6,738,879	339,003	7,119,060	380,181
	20	136,152,903	340,382	939,293	5,788,108	14,470	340,382	93,576	500,000	6,736,537	339,003	7,119,060	382,523
	21	135,213,607	338,034	941,641	5,788,108	14,470	338,034	93,576	500,000	6,734,189	339,003	7,119,060	384,871
	22	134,271,966	335,680	943,995	5,788,108	14,470	335,680	93,576	500,000	6,731,835	339,003	7,119,060	387,225
	23	133,327,971	333,320	946,355	5,788,108	14,470	333,320	93,576	500,000	6,729,475	339,003	7,119,060	389,585
	24	132,381,616	330,954	948,721	5,788,108	14,470	330,954	93,576	500,000	6,727,109	339,003	7,119,060	391,951
3	25	131,432,895	328,582	951,093	5,788,108	14,470	328,582	93,576	500,000	6,724,737	339,003	7,119,060	394,323
	26	130,481,802	326,205	953,470	5,788,108	14,470	326,205	93,576	500,000	6,722,359	339,003	7,119,060	396,701
	27	129,528,332	323,821	955,854	5,788,108	14,470	323,821	93,576	500,000	6,719,976	339,003	7,119,060	399,085
	28	128,572,478	321,431	958,244	5,788,108	14,470	321,431	93,576	500,000	6,717,586	339,003	7,119,060	401,474
	29	127,614,234	319,036	960,639	5,788,108	14,470	319,036	93,576	500,000	6,715,190	339,003	7,119,060	403,870
	30	126,653,595	316,643	963,041	5,788,108	14,470	316,643	93,576	500,000	6,712,789	339,003	7,119,060	406,271
	31	125,690,551	314,226	965,449	5,788,108	14,470	314,226	93,576	500,000	6,710,381	339,003	7,119,060	408,679
	32	124,725,103	311,813	967,862	5,788,108	14,470	311,813	93,576	500,000	6,707,967	339,003	7,119,060	411,093
	33	123,757,243	309,393	970,282	5,788,108	14,470	309,393	93,576	500,000	6,705,548	339,003	7,119,060	413,512
	34	122,786,961	306,967	972,708	5,788,108	14,470	306,967	93,576	500,000	6,703,122	339,003	7,119,060	415,938
	35	121,814,253	304,536	975,139	5,788,108	14,470	304,536	93,576	500,000	6,700,690	339,003	7,119,060	418,370
	36	120,839,114	302,098	977,577	5,788,108	14,470	302,098	93,576	500,000	6,698,252	339,003	7,119,060	420,808
4	37	119,861,537	299,651	980,021	5,788,108	14,470	299,651	93,576	500,000	6,695,809	339,003	7,119,060	423,252
	38	118,881,515	297,204	982,471	5,788,108	14,470	297,204	93,576	500,000	6,693,358	339,003	7,119,060	425,707
	39	117,899,044	294,748	984,927	5,788,108	14,470	294,748	93,576	500,000	6,690,902	339,003	7,119,060	428,158
	40	116,914,117	292,285	987,390	5,788,108	14,470	292,285	93,576	500,000	6,688,440	339,003	7,119,060	430,620
	41	115,926,727	289,817	989,858	5,788,108	14,470	289,817	93,576	500,000	6,685,972	339,003	7,119,060	433,089
	42	114,936,869	287,342	992,333	5,788,108	14,470	287,342	93,576	500,000	6,683,497	339,003	7,119,060	435,563
	43	113,944,536	284,861	994,814	5,788,108	14,470	284,861	93,576	500,000	6,681,016	339,003	7,119,060	438,044
	44	112,949,723	282,374	997,301	5,788,108	14,470	282,374	93,576	500,000	6,678,529	339,003	7,119,060	440,531
	45	111,952,422	279,881	999,794	5,788,108	14,470	279,881	93,576	500,000	6,676,036	339,003	7,119,060	443,024
	46	110,952,628	277,382	1,002,293	5,788,108	14,470	277,382	93,576	500,000	6,673,536	339,003	7,119,060	445,524
	47	109,950,334	274,876	1,004,799	5,788,108	14,470	274,876	93,576	500,000	6,671,031	339,003	7,119,060	448,030
	48	108,945,535	272,364	1,007,311	5,788,108	14,470	272,364	93,576	500,000	6,668,519	339,003	7,119,060	450,542
5	49	107,938,224	269,846	1,009,829	5,788,108	14,470	269,846	93,576	500,000	6,666,000	339,003	7,119,060	453,060
	50	106,928,395	267,321	1,012,354	5,788,108	14,470	267,321	93,576	500,000	6,663,476	339,003	7,119,060	455,584
	51	105,916,041	264,790	1,014,883	5,788,108	14,470	264,790	93,576	500,000	6,660,945	339,003	7,119,060	458,115
	52	104,901,156	262,255	1,017,423	5,788,108	14,470	262,253	93,576	500,000	6,658,408	339,003	7,119,060	460,652
	53	103,883,738	259,709	1,019,966	5,788,108	14,470	259,709	93,576	500,000	6,655,864	339,003	7,119,060	463,196
	54	102,863,768	257,159	1,022,516	5,788,108	14,470	257,159	93,576	500,000	6,653,314	339,003	7,119,060	465,746
	55	101,841,252	254,603	1,025,072	5,788,108	14,470	254,603	93,576	500,000	6,650,758	339,003	7,119,060	468,302
	56	100,816,181	252,040	1,027,635	5,788,108	14,470	252,040	93,576	500,000	6,648,195	339,003	7,119,060	470,865
	57	99,788,536	249,471	1,030,204	5,788,108	14,470	249,471	93,576	500,000	6,645,626	339,003	7,119,060	473,434
	58	98,758,342	246,896	1,032,779	5,788,108	14,470	246,896	93,576	500,000	6,643,051	339,003	7,119,060	476,010
	59	97,725,563	244,314	1,035,361	5,788,108	14,470	244,314	93,576	500,000	6,640,469	339,003	7,119,060	478,591
	60	96,690,202	241,726	1,037,949	5,788,108	14,470	241,726	93,576	500,000	6,637,880	339,003	7,119,060	481,180
6	61	95,652,253	239,131	1,040,544	5,788,108	14,470	239,131	93,576	500,000	6,635,285	339,003	7,119,060	483,775
	62	94,611,708	236,529	1,043,146	5,788,108	14,470	236,529	93,576	500,000	6,632,684	339,003	7,119,060	486,376
	63	93,568,563	233,921	1,045,754	5,788,108	14,470	233,921	93,576	500,000	6,630,076	339,003	7,119,060	488,984
	64	92,522,807	231,307	1,048,368	5,788,108	14,470	231,307	93,576	500,000	6,627,462	339,003	7,119,060	491,598
	65	91,474,441	228,686	1,050,989	5,788,108	14,470	228,686	93,576	500,000	6,624,841	339,003	7,119,060	494,219
	66	90,423,452	226,059	1,053,616	5,788,108	14,470	226,059	93,576	500,000	6,622,213	339,003	7,119,060	496,847
	67	89,369,836	223,423	1,056,250	5,788,108	14,470	223,425	93,576	500,000	6,619,579	339,003	7,119,060	499,481
	68	88,313,585	220,784	1,058,891	5,788,108	14,470	220,784	93,57,					

80	75,430,712	188,577	1,091,098	5,788,108	14,470	188,577	93,576	500,000	6,984,731	339,003	7,119,060	534,329
81	74,339,613	185,849	1,093,826	5,788,108	14,470	185,849	93,576	500,000	6,982,004	339,003	7,119,060	537,056
82	73,245,787	183,114	1,096,561	5,788,108	14,470	183,114	93,576	500,000	6,979,269	339,003	7,119,060	539,791
83	72,149,227	180,373	1,099,302	5,788,108	14,470	180,373	93,576	500,000	6,976,528	339,003	7,119,060	542,523
84	71,049,925	177,625	1,102,050	5,788,108	14,470	177,625	93,576	500,000	6,973,779	339,003	7,119,060	545,281
85	69,947,875	174,870	1,104,805	5,788,108	14,470	174,870	93,576	500,000	6,971,024	339,003	7,119,060	548,036
86	68,843,069	172,108	1,107,567	5,788,108	14,470	172,108	93,576	500,000	6,968,262	339,003	7,119,060	550,798
87	67,735,502	169,339	1,110,336	5,788,108	14,470	169,339	93,576	500,000	6,965,493	339,003	7,119,060	553,567
88	66,625,166	166,563	1,113,112	5,788,108	14,470	166,563	93,576	500,000	6,962,718	339,003	7,119,060	556,342
89	65,512,054	163,780	1,115,895	5,788,108	14,470	163,780	93,576	500,000	6,959,935	339,003	7,119,060	559,125
90	64,396,139	160,990	1,118,685	5,788,108	14,470	160,990	93,576	500,000	6,957,145	339,003	7,119,060	561,915
91	63,277,474	158,194	1,121,481	5,788,108	14,470	158,194	93,576	500,000	6,954,348	339,003	7,119,060	564,712
92	62,153,993	155,390	1,124,285	5,788,108	14,470	155,390	93,576	500,000	6,951,545	339,003	7,119,060	567,515
93	61,031,708	152,579	1,127,096	5,788,108	14,470	152,579	93,576	500,000	6,948,734	339,003	7,119,060	570,326
94	59,904,612	149,762	1,129,913	5,788,108	14,470	149,762	93,576	500,000	6,945,916	339,003	7,119,060	573,144
95	58,774,699	146,937	1,132,738	5,788,108	14,470	146,937	93,576	500,000	6,943,091	339,003	7,119,060	575,969
96	57,641,961	144,105	1,135,570	5,788,108	14,470	144,105	93,576	500,000	6,940,260	339,003	7,119,060	578,800
97	56,506,390	141,266	1,138,409	5,788,108	14,470	141,266	93,576	500,000	6,937,421	339,003	7,119,060	581,639
98	55,367,981	138,420	1,141,255	5,788,108	14,470	138,420	93,576	500,000	6,934,575	339,003	7,119,060	584,485
99	54,226,728	135,567	1,144,108	5,788,108	14,470	135,567	93,576	500,000	6,931,722	339,003	7,119,060	587,339
100	53,082,618	132,707	1,146,968	5,788,108	14,470	132,707	93,576	500,000	6,928,861	339,003	7,119,060	590,199
101	51,935,650	129,839	1,149,836	5,788,108	14,470	129,839	93,576	500,000	6,925,994	339,003	7,119,060	593,066
102	50,785,814	126,965	1,152,710	5,788,108	14,470	126,965	93,576	500,000	6,923,119	339,003	7,119,060	595,941
103	49,633,103	124,083	1,155,592	5,788,108	14,470	124,083	93,576	500,000	6,920,237	339,003	7,119,060	598,823
104	48,477,511	121,194	1,158,481	5,788,108	14,470	121,194	93,576	500,000	6,917,348	339,003	7,119,060	601,712
105	47,319,030	118,298	1,161,377	5,788,108	14,470	118,298	93,576	500,000	6,914,452	339,003	7,119,060	604,608
106	46,157,653	115,394	1,164,281	5,788,108	14,470	115,394	93,576	500,000	6,911,549	339,003	7,119,060	607,511
107	44,993,372	112,483	1,167,192	5,788,108	14,470	112,483	93,576	500,000	6,908,638	339,003	7,119,060	610,422
108	43,826,180	109,565	1,170,110	5,788,108	14,470	109,565	93,576	500,000	6,905,720	339,003	7,119,060	613,340
109	42,656,071	106,640	1,173,035	5,788,108	14,470	106,640	93,576	500,000	6,902,795	339,003	7,119,060	616,265
110	41,483,036	103,708	1,175,967	5,788,108	14,470	103,708	93,576	500,000	6,899,862	339,003	7,119,060	619,198
111	40,307,068	100,768	1,178,907	5,788,108	14,470	100,768	93,576	500,000	6,896,922	339,003	7,119,060	622,138
112	39,128,161	97,820	1,181,855	5,788,108	14,470	97,820	93,576	500,000	6,893,975	339,003	7,119,060	625,085
113	37,946,306	94,866	1,184,809	5,788,108	14,470	94,866	93,576	500,000	6,891,020	339,003	7,119,060	628,040
114	36,761,497	91,904	1,187,771	5,788,108	14,470	91,904	93,576	500,000	6,888,058	339,003	7,119,060	631,002
115	35,573,726	88,934	1,190,741	5,788,108	14,470	88,934	93,576	500,000	6,885,089	339,003	7,119,060	633,971
116	34,382,985	85,957	1,193,718	5,788,108	14,470	85,957	93,576	500,000	6,882,112	339,003	7,119,060	636,948
117	33,189,268	82,973	1,196,702	5,788,108	14,470	82,973	93,576	500,000	6,879,128	339,003	7,119,060	639,932
118	31,992,566	79,981	1,199,694	5,788,108	14,470	79,981	93,576	500,000	6,876,136	339,003	7,119,060	642,923
119	30,792,872	76,982	1,202,693	5,788,108	14,470	76,982	93,576	500,000	6,873,137	339,003	7,119,060	645,920
120	29,590,179	73,975	1,205,700	5,788,108	14,470	73,975	93,576	500,000	6,870,130	339,003	7,119,060	648,920
121	28,384,440	70,961	1,208,714	5,788,108	14,470	70,961	93,576	500,000	6,867,116	339,003	7,119,060	651,944
122	27,175,766	67,939	1,211,736	5,788,108	14,470	67,939	93,576	500,000	6,864,094	339,003	7,119,060	654,966
123	25,964,030	64,910	1,214,765	5,788,108	14,470	64,910	93,576	500,000	6,861,065	339,003	7,119,060	657,995
124	24,749,266	61,873	1,217,802	5,788,108	14,470	61,873	93,576	500,000	6,858,028	339,003	7,119,060	661,032
125	23,531,464	58,829	1,220,846	5,788,108	14,470	58,829	93,576	500,000	6,854,983	339,003	7,119,060	664,077
126	22,310,617	55,777	1,223,898	5,788,108	14,470	55,777	93,576	500,000	6,851,931	339,003	7,119,060	667,129
127	21,089,719	52,717	1,226,958	5,788,108	14,470	52,717	93,576	500,000	6,848,871	339,003	7,119,060	670,189
128	19,869,761	49,649	1,230,026	5,788,108	14,470	49,649	93,576	500,000	6,845,804	339,003	7,119,060	673,256
129	18,649,735	46,574	1,233,101	5,788,108	14,470	46,574	93,576	500,000	6,842,729	339,003	7,119,060	676,331
130	17,429,634	43,492	1,236,183	5,788,108	14,470	43,492	93,576	500,000	6,839,646	339,003	7,119,060	679,414
131	16,209,451	40,401	1,239,274	5,788,108	14,470	40,401	93,576	500,000	6,836,556	339,003	7,119,060	682,504
132	14,991,177	37,303	1,242,372	5,788,108	14,470	37,303	93,576	500,000	6,833,458	339,003	7,119,060	685,602
133	13,678,805	34,197	1,245,478	5,788,108	14,470	34,197	93,576	500,000	6,830,353	339,003	7,119,060	688,708
134	12,433,327	31,083	1,248,592	5,788,108	14,470	31,083	93,576	500,000	6,827,238	339,003	7,119,060	691,822
135	11,184,735	27,962	1,251,713	5,788,108	14,470	27,962	93,576	500,000	6,824,117	339,003	7,119,060	694,944
136	9,933,022	24,833	1,254,842	5,788,108	14,470	24,833	93,576	500,000	6,820,987	339,003	7,119,060	698,073
137	8,678,180	21,695	1,257,980	5,788,108	14,470	21,695	93,576	500,000	6,817,850	339,003	7,119,060	701,210
138	7,420,200	18,551	1,261,124	5,788,108	14,470	18,551	93,576	500,000	6,814,705	339,003	7,119,060	704,355
139	6,159,076	15,398	1,264,277	5,788,108	14,470	15,398	93,576	500,000	6,811,552	339,003	7,119,060	707,508
140	4,894,798	12,237	1,267,438	5,788,108	14,470	12,237	93,576	500,000	6,808,392	339,003	7,119,060	710,668
141	3,627,360	9,068	1,270,607	5,788,108	14,470	9,068	93,576	500,000	6,805,223	339,003	7,119,060	713,833
142	2,356,754	5,892	1,273,783	5,788,108	14,470	5,892	93,576	500,000	6,802,047	339,003	7,119,060	717,013
143	1,082,971	2,707	1,082,971	5,788,108	14,470	2,707	93,576	500,000	6,798,862	339,003	7,119,060	720,198
Total		133,561,000	827,699,492	2,069,249	29,238,528	13,381,380	71,500,000	930,507,269	48,477,409	1,018,025,587	87,518,318	

Appendix - Table 7. Monthly accounts of production cost of FMP by a fuel method (Annual output of phosphate= 60,000 tons,

Gross margin of ore: 10 %, Interest rates: 3.0 %, Private power supply)

		Invested capital, \$66,100,000	Annual depreciation, \$0,528,000		Price of ore: Rs. 1,492		Initial gross margin: -3.93 %						
		Private power supply	Annual interest rate: 3.0 %		Production cost, Rs. 3,747/ton		Total gross margin: -2.12 %						
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Total production cost	Proceeds (Rs.2,700/ton)	Government subsidy (Rs.900/ton)	Revenues	Profit and loss	
1	1	566,100,000	1,415,250	2,795,417	17,901,134	44,753	1,415,250	19,361,137	13,950,000	4,650,000	18,600,000	-761,137	
	2	563,304,583	1,408,261	2,802,405	17,859,801	3,721	1,408,261	19,271,783	13,950,000	4,650,000	18,600,000	-671,783	
	3	560,502,178	1,401,255	2,809,411	17,819,801	3,721	1,401,255	19,182,777	13,950,000	4,650,000	18,600,000	-582,777	
	4	557,692,767	1,394,232	2,816,415	17,779,801	3,721	1,394,232	19,093,754	13,950,000	4,650,000	18,600,000	-493,754	
	5	554,876,332	1,387,191	2,823,476	17,739,801	3,721	1,387,191	19,004,713	13,950,000	4,650,000	18,600,000	-404,713	
	6	552,052,856	1,380,132	2,830,535	17,699,801	3,721	1,380,132	18,915,654	13,950,000	4,650,000	18,600,000	-315,654	
	7	549,223,322	1,373,056	2,837,611	17,659,801	3,721	1,373,056	18,826,578	13,950,000	4,650,000	18,600,000	-226,578	
	8	546,394,711	1,365,962	2,844,705	17,619,801	3,721	1,365,962	18,737,484	13,950,000	4,650,000	18,600,000	-137,484	
	9	543,560,006	1,358,850	2,851,817	17,579,801	3,721	1,358,850	18,648,350	13,950,000	4,650,000	18,600,000	-48,350	
	10	540,684,189	1,351,720	2,858,946	17,539,801	3,721	1,351,720	18,559,125	13,950,000	4,650,000	18,600,000	42,125	
	11	537,829,243	1,344,573	2,866,004	17,499,801	3,721	1,344,573	18,469,825	13,950,000	4,650,000	18,600,000	133,825	
	12	534,963,150	1,337,408	2,873,099	17,459,801	3,721	1,337,408	18,380,430	13,950,000	4,650,000	18,600,000	244,430	
	2	13	532,089,891	1,330,225	2,880,244	17,419,801	3,721	1,330,225	18,291,035	13,950,000	4,650,000	18,600,000	355,035
		14	529,209,449	1,323,024	2,887,343	17,379,801	3,721	1,323,024	18,201,545	13,950,000	4,650,000	18,600,000	465,545
		15	526,331,806	1,315,805	2,894,462	17,339,801	3,721	1,315,805	18,112,055	13,950,000	4,650,000	18,600,000	576,055
		16	523,426,944	1,308,567	2,901,597	17,299,801	3,721	1,308,567	18,022,469	13,950,000	4,650,000	18,600,000	686,565
		17	520,524,844	1,301,312	2,908,755	17,259,801	3,721	1,301,312	17,932,884	13,950,000	4,650,000	18,600,000	797,075
		18	517,615,400	1,294,039	2,916,028	17,219,801	3,721	1,294,039	17,843,299	13,950,000	4,650,000	18,600,000	907,585
		19	514,698,862	1,286,747	2,923,970	17,179,801	3,721	1,286,747	17,753,714	13,950,000	4,650,000	18,600,000	1,018,095
		20	511,774,942	1,279,437	2,931,259	17,139,801	3,721	1,279,437	17,664,129	13,950,000	4,650,000	18,600,000	1,128,605
		21	508,843,713	1,272,109	2,938,557	17,099,801	3,721	1,272,109	17,574,544	13,950,000	4,650,000	18,600,000	1,239,115
		22	505,903,156	1,264,763	2,945,804	17,059,801	3,721	1,264,763	17,484,959	13,950,000	4,650,000	18,600,000	1,349,625
		23	502,959,252	1,257,398	2,953,269	17,019,801	3,721	1,257,398	17,395,374	13,950,000	4,650,000	18,600,000	1,460,135
		24	500,003,983	1,250,015	2,960,652	16,979,801	3,721	1,250,015	17,305,789	13,950,000	4,650,000	18,600,000	1,570,645
3		25	497,043,332	1,242,613	2,968,053	16,939,801	3,721	1,242,613	17,216,204	13,950,000	4,650,000	18,600,000	1,681,155
		26	494,077,278	1,235,191	2,975,473	16,899,801	3,721	1,235,191	17,126,619	13,950,000	4,650,000	18,600,000	1,791,665
		27	491,101,805	1,227,755	2,982,912	16,859,801	3,721	1,227,755	17,037,034	13,950,000	4,650,000	18,600,000	1,902,175
		28	488,118,893	1,220,297	2,990,369	16,819,801	3,721	1,220,297	16,947,449	13,950,000	4,650,000	18,600,000	2,012,685
		29	485,128,523	1,212,821	2,997,845	16,779,801	3,721	1,212,821	16,857,864	13,950,000	4,650,000	18,600,000	2,123,195
		30	482,130,678	1,205,337	3,005,340	16,739,801	3,721	1,205,337	16,768,279	13,950,000	4,650,000	18,600,000	2,233,705
		31	479,125,338	1,197,833	3,012,853	16,699,801	3,721	1,197,833	16,678,694	13,950,000	4,650,000	18,600,000	2,344,215
		32	476,112,885	1,190,281	3,020,385	16,659,801	3,721	1,190,281	16,589,109	13,950,000	4,650,000	18,600,000	2,454,725
		33	473,092,059	1,182,730	3,027,936	16,619,801	3,721	1,182,730	16,499,524	13,950,000	4,650,000	18,600,000	2,565,235
		34	470,064,163	1,175,160	3,035,506	16,579,801	3,721	1,175,160	16,409,939	13,950,000	4,650,000	18,600,000	2,675,745
		35	467,032,656	1,167,572	3,043,095	16,539,801	3,721	1,167,572	16,320,354	13,950,000	4,650,000	18,600,000	2,786,255
		36	464,001,559	1,159,964	3,050,703	16,499,801	3,721	1,159,964	16,230,769	13,950,000	4,650,000	18,600,000	2,896,765
	37	460,970,459	1,152,337	3,058,330	16,459,801	3,721	1,152,337	16,141,184	13,950,000	4,650,000	18,600,000	3,007,275	
	38	457,939,359	1,144,691	3,065,975	16,419,801	3,721	1,144,691	16,051,599	13,950,000	4,650,000	18,600,000	3,117,785	
	39	454,908,259	1,137,026	3,073,646	16,379,801	3,721	1,137,026	15,962,014	13,950,000	4,650,000	18,600,000	3,228,295	
	40	451,877,159	1,129,342	3,081,344	16,339,801	3,721	1,129,342	15,872,429	13,950,000	4,650,000	18,600,000	3,338,805	
	41	448,846,059	1,121,639	3,089,079	16,299,801	3,721	1,121,639	15,782,844	13,950,000	4,650,000	18,600,000	3,449,315	
	42	445,814,959	1,113,916	3,096,750	16,259,801	3,721	1,113,916	15,693,259	13,950,000	4,650,000	18,600,000	3,559,825	
	43	442,783,859	1,106,175	3,104,492	16,219,801	3,721	1,106,175	15,603,674	13,950,000	4,650,000	18,600,000	3,670,335	
	44	439,752,759	1,098,413	3,112,253	16,179,801	3,721	1,098,413	15,514,089	13,950,000	4,650,000	18,600,000	3,780,845	
	45	436,721,659	1,090,633	3,120,044	16,139,801	3,721	1,090,633	15,424,504	13,950,000	4,650,000	18,600,000	3,891,355	
	46	433,690,559	1,082,833	3,127,864	16,099,801	3,721	1,082,833	15,334,919	13,950,000	4,650,000	18,600,000	4,001,865	
	47	430,659,459	1,075,013	3,135,615	16,059,801	3,721	1,075,013	15,245,334	13,950,000	4,650,000	18,600,000	4,112,375	
	48	427,628,359	1,067,174	3,143,393	16,019,801	3,721	1,067,174	15,155,749	13,950,000	4,650,000	18,600,000	4,222,885	
49	424,597,259	1,059,315	3,151,232	15,979,801	3,721	1,059,315	15,066,164	13,950,000	4,650,000	18,600,000	4,333,395		
50	421,566,159	1,051,437	3,159,100	15,939,801	3,721	1,051,437	14,976,579	13,950,000	4,650,000	18,600,000	4,443,905		
51	418,535,059	1,043,539	3,167,028	15,899,801	3,721	1,043,539	14,886,994	13,950,000	4,650,000	18,600,000	4,554,415		
52	415,503,959	1,035,621	3,174,996	15,859,801	3,721	1,035,621	14,797,409	13,950,000	4,650,000	18,600,000	4,664,925		
53	412,472,859	1,027,683	3,182,963	15,819,801	3,721	1,027,683	14,707,824	13,950,000	4,650,000	18,600,000	4,775,435		
54	409,441,759	1,019,725	3,190,941	15,779,801	3,721	1,019,725	14,618,239	13,950,000	4,650,000	18,600,000	4,885,945		
55	406,410,659	1,011,748	3,198,919	15,739,801	3,721	1,011,748	14,528,654	13,950,000	4,650,000	18,600,000	4,996,455		
56	403,379,559	1,003,751	3,206,916	15,699,801	3,721	1,003,751	14,439,069	13,950,000	4,650,000	18,600,000	5,106,965		
57	400,348,459	995,734	3,214,913	15,659,801	3,721	995,734	14,349,484	13,950,000	4,650,000	18,600,000	5,217,475		
58	397,317,359	987,697	3,222,970	15,619,801	3,721	987,697	14,259,899	13,950,000	4,650,000	18,600,000	5,327,985		
59	394,286,259	979,639	3,231,028	15,579,801	3,721	979,639	14,170,314	13,950,000	4,650,000	18,600,000	5,438,495		
60	391,255,159	971,562	3,239,100	15,539,801	3,721	971,562	14,080,729	13,950,000	4,650,000	18,600,000	5,549,005		
4	61	388,224,059	963,464	3,247,203	15,499,801	3,721	963,464	14,000,144	13,950,000	4,650,000	18,600,000	5,659,515	
	62	385,192,959	955,346	3,255,321	15,459,801	3,721	955,346	13,919,559	13,950,000	4,650,000	18,600,000	5,770,025	
	63	382,161,859	947,207	3,263,469	15,419,801	3,721	947,207	13,838,974	13,950,000	4,650,000	18,600,000	5,880,535	
	64	379,130,759	939,049	3,271,618	15,379,801	3,721	939,049	13,758,389	13,950,000	4,650,000	18,600,000	5,991,045	
	65	376,099,659	930,870	3,279,797	15,339,801	3,721	930,870	13,677,804	13,950,000	4,650,000	18,600,000	6,101,555	
	66	373,068,559	922,672	3,287,999	15,299,801	3,721	922,672	13,597,219	13,950,000	4,650,000	18,600,000	6,212,065	
	67	370,037,459	914,450	3,296,216	15,259,801	3,721	914,450	13,516,634	13,950,000	4,650,000	18,600,000	6,322,575	

81	318,875,638	797,189	3,413,478	17,899,801	3,721	797,189	18,660,711	13,950,000	+650,000	18,600,000	-60,711
82	315,462,161	788,655	3,422,011	17,899,801	3,721	788,655	18,652,177	13,950,000	+650,000	18,600,000	-52,177
83	312,040,150	780,100	3,430,566	17,899,801	3,721	780,100	18,643,622	13,950,000	+650,000	18,600,000	-43,622
84	308,609,583	771,524	3,439,143	17,899,801	3,721	771,524	18,635,046	13,950,000	+650,000	18,600,000	-35,046
85	305,170,441	762,926	3,447,741	17,899,801	3,721	762,926	18,626,448	13,950,000	+650,000	18,600,000	-26,448
86	301,722,700	754,307	3,456,366	17,899,801	3,721	754,307	18,617,829	13,950,000	+650,000	18,600,000	-17,829
87	298,266,340	745,666	3,465,001	17,899,801	3,721	745,666	18,609,188	13,950,000	+650,000	18,600,000	-9,188
88	294,801,339	737,003	3,473,663	17,899,801	3,721	737,003	18,600,525	13,950,000	+650,000	18,600,000	-9,525
89	291,327,676	728,319	3,482,347	17,899,801	3,721	728,319	18,591,841	13,950,000	+650,000	18,600,000	-8,159
90	287,845,128	719,613	3,491,053	17,899,801	3,721	719,613	18,583,135	13,950,000	+650,000	18,600,000	-16,865
91	284,354,275	710,886	3,499,781	17,899,801	3,721	710,886	18,574,407	13,950,000	+650,000	18,600,000	-25,593
92	280,854,494	702,136	3,508,530	17,899,801	3,721	702,136	18,565,658	13,950,000	+650,000	18,600,000	-34,342
93	277,345,964	693,365	3,517,302	17,899,801	3,721	693,365	18,556,887	13,950,000	+650,000	18,600,000	-43,111
94	273,828,662	684,572	3,526,045	17,899,801	3,721	684,572	18,548,093	13,950,000	+650,000	18,600,000	-51,907
95	270,302,567	675,756	3,534,910	17,899,801	3,721	675,756	18,539,278	13,950,000	+650,000	18,600,000	-60,722
96	266,767,657	666,919	3,543,748	17,899,801	3,721	666,919	18,530,441	13,950,000	+650,000	18,600,000	-69,559
97	263,223,909	658,060	3,552,607	17,899,801	3,721	658,060	18,521,582	13,950,000	+650,000	18,600,000	-78,418
98	259,671,302	649,178	3,561,488	17,899,801	3,721	649,178	18,512,700	13,950,000	+650,000	18,600,000	-87,300
99	256,109,814	640,275	3,570,392	17,899,801	3,721	640,275	18,503,796	13,950,000	+650,000	18,600,000	-96,204
100	252,539,422	631,349	3,579,318	17,899,801	3,721	631,349	18,494,870	13,950,000	+650,000	18,600,000	-105,130
101	248,960,104	622,400	3,588,266	17,899,801	3,721	622,400	18,485,922	13,950,000	+650,000	18,600,000	-114,078
102	245,371,837	613,430	3,597,217	17,899,801	3,721	613,430	18,476,951	13,950,000	+650,000	18,600,000	-123,049
103	241,774,600	604,437	3,606,230	17,899,801	3,721	604,437	18,467,958	13,950,000	+650,000	18,600,000	-132,042
104	238,168,370	595,421	3,615,246	17,899,801	3,721	595,421	18,458,943	13,950,000	+650,000	18,600,000	-141,057
105	234,553,124	586,380	3,624,284	17,899,801	3,721	586,380	18,449,905	13,950,000	+650,000	18,600,000	-150,095
106	230,928,840	577,322	3,633,345	17,899,801	3,721	577,322	18,440,844	13,950,000	+650,000	18,600,000	-159,156
107	227,295,496	568,239	3,642,428	17,899,801	3,721	568,239	18,431,761	13,950,000	+650,000	18,600,000	-168,239
108	223,653,068	559,133	3,651,534	17,899,801	3,721	559,133	18,422,654	13,950,000	+650,000	18,600,000	-177,346
109	220,001,534	550,004	3,660,663	17,899,801	3,721	550,004	18,413,526	13,950,000	+650,000	18,600,000	-186,471
110	216,340,871	540,852	3,669,813	17,899,801	3,721	540,852	18,404,374	13,950,000	+650,000	18,600,000	-195,626
111	212,671,057	531,678	3,678,989	17,899,801	3,721	531,678	18,395,199	13,950,000	+650,000	18,600,000	-204,801
112	208,992,067	522,480	3,688,186	17,899,801	3,721	522,480	18,386,002	13,950,000	+650,000	18,600,000	-213,998
113	205,303,981	513,260	3,697,407	17,899,801	3,721	513,260	18,376,781	13,950,000	+650,000	18,600,000	-223,219
114	201,606,474	504,016	3,706,650	17,899,801	3,721	504,016	18,367,538	13,950,000	+650,000	18,600,000	-232,462
115	197,899,824	494,750	3,715,917	17,899,801	3,721	494,750	18,358,271	13,950,000	+650,000	18,600,000	-241,729
116	194,183,906	485,460	3,725,207	17,899,801	3,721	485,460	18,348,982	13,950,000	+650,000	18,600,000	-251,018
117	190,458,700	476,147	3,734,520	17,899,801	3,721	476,147	18,339,669	13,950,000	+650,000	18,600,000	-260,331
118	186,724,180	466,810	3,743,856	17,899,801	3,721	466,810	18,330,332	13,950,000	+650,000	18,600,000	-269,668
119	182,980,323	457,451	3,753,216	17,899,801	3,721	457,451	18,320,973	13,950,000	+650,000	18,600,000	-279,027
120	179,227,108	448,068	3,762,599	17,899,801	3,721	448,068	18,311,590	13,950,000	+650,000	18,600,000	-288,410
121	175,464,509	438,661	3,772,005	17,899,801	3,721	438,661	18,302,183	13,950,000	+650,000	18,600,000	-297,817
122	171,692,303	429,231	3,781,435	17,899,801	3,721	429,231	18,292,753	13,950,000	+650,000	18,600,000	-307,247
123	167,911,068	419,778	3,790,889	17,899,801	3,721	419,778	18,283,299	13,950,000	+650,000	18,600,000	-316,701
124	164,120,179	410,300	3,800,366	17,899,801	3,721	410,300	18,273,822	13,950,000	+650,000	18,600,000	-326,178
125	160,319,813	400,800	3,809,867	17,899,801	3,721	400,800	18,264,321	13,950,000	+650,000	18,600,000	-335,679
126	156,509,945	391,275	3,819,392	17,899,801	3,721	391,275	18,254,797	13,950,000	+650,000	18,600,000	-345,202
127	152,690,554	381,726	3,828,940	17,899,801	3,721	381,726	18,245,248	13,950,000	+650,000	18,600,000	-354,752
128	148,861,613	372,154	3,838,513	17,899,801	3,721	372,154	18,235,676	13,950,000	+650,000	18,600,000	-364,324
129	145,023,101	362,558	3,848,109	17,899,801	3,721	362,558	18,226,080	13,950,000	+650,000	18,600,000	-373,920
130	141,174,992	352,937	3,857,729	17,899,801	3,721	352,937	18,216,459	13,950,000	+650,000	18,600,000	-383,541
131	137,317,263	343,293	3,867,374	17,899,801	3,721	343,293	18,206,813	13,950,000	+650,000	18,600,000	-393,185
132	133,449,889	333,625	3,877,042	17,899,801	3,721	333,625	18,197,147	13,950,000	+650,000	18,600,000	-402,853
133	129,572,847	323,932	3,886,735	17,899,801	3,721	323,932	18,187,454	13,950,000	+650,000	18,600,000	-412,546
134	125,686,113	314,215	3,896,451	17,899,801	3,721	314,215	18,177,737	13,950,000	+650,000	18,600,000	-422,263
135	121,789,661	304,474	3,906,193	17,899,801	3,721	304,474	18,167,996	13,950,000	+650,000	18,600,000	-432,004
136	117,883,469	294,709	3,915,958	17,899,801	3,721	294,709	18,158,230	13,950,000	+650,000	18,600,000	-441,770
137	113,967,511	284,919	3,925,744	17,899,801	3,721	284,919	18,148,441	13,950,000	+650,000	18,600,000	-451,559
138	110,041,763	275,104	3,935,562	17,899,801	3,721	275,104	18,138,626	13,950,000	+650,000	18,600,000	-461,374
139	106,108,201	265,266	3,945,401	17,899,801	3,721	265,266	18,128,787	13,950,000	+650,000	18,600,000	-471,213
140	102,168,799	255,402	3,955,265	17,899,801	3,721	255,402	18,118,924	13,950,000	+650,000	18,600,000	-481,076
141	98,205,535	245,514	3,965,153	17,899,801	3,721	245,514	18,109,036	13,950,000	+650,000	18,600,000	-490,964
142	94,240,382	235,601	3,975,066	17,899,801	3,721	235,601	18,099,123	13,950,000	+650,000	18,600,000	-500,877
143	90,265,316	225,663	3,985,000	17,899,801	3,721	225,663	18,089,185	13,950,000	+650,000	18,600,000	-510,815
144	86,280,313	215,701	3,994,966	17,899,801	3,721	215,701	18,079,223	13,950,000	+650,000	18,600,000	-520,777
145	82,285,347	205,713	4,004,953	17,899,801	3,721	205,713	18,069,235	13,950,000	+650,000	18,600,000	-530,765
146	78,280,394	195,701	4,014,966	17,899,801	3,721	195,701	18,059,223	13,950,000	+650,000	18,600,000	-540,777
147	74,265,428	185,664	4,025,003	17,899,801	3,721	185,664	18,049,180	13,950,000	+650,000	18,600,000	-550,815
148	70,240,425	175,601	4,035,066	17,899,801	3,721	175,601	18,039,123	13,950,000	+650,000	18,600,000	-560,877
149	66,205,359	165,513	4,045,153	17,899,801	3,721	165,513	18,029,035	13,950,000	+650,000	18,600,000	-570,965
150	62,160,206	155,401	4,055,266	17,899,801	3,721	155,401	18,018,922	13,950,000	+650,000	18,600,000	-581,078
151	58,104,940	145,262	4,065,404	17,899,801	3,721	145,262	18,008,784	13,950,000	+650,000	18,600,000	-591,216
152	54,039,536	135,099	4,075,568	17,899,801	3,721	135,099	17,998,621	13,950,000	+650,000	18,600,000	-601,379
153	49,963,968	124,910	4,085,757	17,899,801	3,721	124,910	17,988,432	13,950,000	+650,000	18,600,000	-611,568
154	45,878,211	114,696	4,095,971	17,899,801	3,721	114,696	17,978,217	13,950,000	+650,000	18,600,000	-621,783
155	41,782,230	104,456	4,106,211	17,899,801	3,721	104,456	17,967,977	13,950,000	+650,000	18,600,000	-632,023
156	37,676,029	94,190	4,116,477	17,899,801	3,721	94,190	17,957,712	13,950,000	+650,000	18,600,000	-642,288
157	33,559,553	83,899	4,126,768	17,899,801	3,721	83,899	17,947,421	13,950,000	+650,000	18,600,000	-652,579
158	29,432,78										

Appendix - Table 8. Monthly accounts of production cost of FMP by a fuel method (Annual output of phosphate= 60,000 tons;

Gross margin of ore: 10 %; Interest rate=3.0 %, Public power supply)

Invested capital: 482,100,000		Annual depreciation: 44,928,000		Price of phosphate ore: Rs. 1,492		Initial gross margin: 0.60 %						
Public power supply		Annual interest rate: 3.0 %		Production cost: Rs.3,572/ton		Total gross margin: 3.96 %						
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Total production costs	Proceeds (Rs.2,700/ton)	Government subsidy (Rs.900/ton)	Revenues	Profit and loss
1	1	482,100,000	1,205,250	2,538,750	17,204,997	43,012	1,205,250	18,433,259	13,950,000	4,650,000	18,600,000	146,741
	2	479,561,250	1,198,903	2,545,097	17,204,997	43,012	1,198,903	18,446,912	13,950,000	4,650,000	18,600,000	153,088
	3	477,016,153	1,192,540	2,551,460	17,204,997	43,012	1,192,540	18,460,590	13,950,000	4,650,000	18,600,000	159,450
	4	474,464,694	1,186,162	2,557,838	17,204,997	43,012	1,186,162	18,474,371	13,950,000	4,650,000	18,600,000	165,829
	5	471,906,855	1,179,767	2,564,233	17,204,997	43,012	1,179,767	18,488,276	13,950,000	4,650,000	18,600,000	172,224
	6	469,342,622	1,173,357	2,570,643	17,204,997	43,012	1,173,357	18,502,366	13,950,000	4,650,000	18,600,000	178,634
	7	466,771,979	1,166,930	2,577,070	17,204,997	43,012	1,166,930	18,516,499	13,950,000	4,650,000	18,600,000	185,061
	8	464,194,509	1,160,487	2,583,513	17,204,997	43,012	1,160,487	18,530,684	13,950,000	4,650,000	18,600,000	191,504
	9	461,611,396	1,154,028	2,589,972	17,204,997	43,012	1,154,028	18,544,938	13,950,000	4,650,000	18,600,000	197,962
	10	459,021,425	1,147,554	2,596,446	17,204,997	43,012	1,147,554	18,559,352	13,950,000	4,650,000	18,600,000	204,437
	11	456,424,978	1,141,062	2,602,938	17,204,997	43,012	1,141,062	18,573,972	13,950,000	4,650,000	18,600,000	210,928
	12	453,822,041	1,134,555	2,609,445	17,204,997	43,012	1,134,555	18,588,564	13,950,000	4,650,000	18,600,000	217,436
2	13	451,212,596	1,128,031	2,615,969	17,204,997	43,012	1,128,031	18,603,041	13,950,000	4,650,000	18,600,000	223,959
	14	448,596,627	1,121,492	2,622,508	17,204,997	43,012	1,121,492	18,617,501	13,950,000	4,650,000	18,600,000	230,499
	15	445,974,119	1,114,935	2,629,055	17,204,997	43,012	1,114,935	18,631,944	13,950,000	4,650,000	18,600,000	237,056
	16	443,345,054	1,108,363	2,635,637	17,204,997	43,012	1,108,363	18,646,372	13,950,000	4,650,000	18,600,000	243,628
	17	440,709,417	1,101,774	2,642,226	17,204,997	43,012	1,101,774	18,660,784	13,950,000	4,650,000	18,600,000	250,217
	18	438,067,190	1,095,168	2,648,802	17,204,997	43,012	1,095,168	18,675,177	13,950,000	4,650,000	18,600,000	256,823
	19	435,418,358	1,088,546	2,655,454	17,204,997	43,012	1,088,546	18,689,553	13,950,000	4,650,000	18,600,000	263,445
	20	432,762,904	1,081,907	2,662,093	17,204,997	43,012	1,081,907	18,703,916	13,950,000	4,650,000	18,600,000	270,084
	21	430,100,811	1,075,252	2,668,748	17,204,997	43,012	1,075,252	18,718,261	13,950,000	4,650,000	18,600,000	276,739
	22	427,432,063	1,068,580	2,675,420	17,204,997	43,012	1,068,580	18,732,589	13,950,000	4,650,000	18,600,000	283,411
	23	424,756,644	1,061,892	2,682,108	17,204,997	43,012	1,061,892	18,746,901	13,950,000	4,650,000	18,600,000	290,099
	24	422,074,535	1,055,186	2,688,814	17,204,997	43,012	1,055,186	18,761,195	13,950,000	4,650,000	18,600,000	296,805
3	25	419,383,722	1,048,464	2,695,536	17,204,997	43,012	1,048,464	18,775,477	13,950,000	4,650,000	18,600,000	303,527
	26	416,690,186	1,041,725	2,702,275	17,204,997	43,012	1,041,725	18,789,735	13,950,000	4,650,000	18,600,000	310,263
	27	413,987,911	1,034,970	2,709,030	17,204,997	43,012	1,034,970	18,803,979	13,950,000	4,650,000	18,600,000	317,017
	28	411,278,881	1,028,197	2,715,803	17,204,997	43,012	1,028,197	18,818,206	13,950,000	4,650,000	18,600,000	323,794
	29	408,563,078	1,021,408	2,722,597	17,204,997	43,012	1,021,408	18,832,417	13,950,000	4,650,000	18,600,000	330,593
	30	405,840,486	1,014,601	2,729,399	17,204,997	43,012	1,014,601	18,846,610	13,950,000	4,650,000	18,600,000	337,410
	31	403,111,087	1,007,778	2,736,222	17,204,997	43,012	1,007,778	18,860,787	13,950,000	4,650,000	18,600,000	344,243
	32	400,374,865	1,000,937	2,743,063	17,204,997	43,012	1,000,937	18,874,946	13,950,000	4,650,000	18,600,000	351,094
	33	397,631,802	994,080	2,749,920	17,204,997	43,012	994,080	18,889,089	13,950,000	4,650,000	18,600,000	357,971
	34	394,881,882	987,205	2,756,795	17,204,997	43,012	987,205	18,903,215	13,950,000	4,650,000	18,600,000	364,866
	35	392,125,086	980,313	2,763,687	17,204,997	43,012	980,313	18,917,322	13,950,000	4,650,000	18,600,000	371,778
	36	389,361,399	973,403	2,770,597	17,204,997	43,012	973,403	18,931,411	13,950,000	4,650,000	18,600,000	378,707
4	37	386,590,803	966,477	2,777,533	17,204,997	43,012	966,477	18,945,486	13,950,000	4,650,000	18,600,000	385,654
	38	383,813,280	959,533	2,784,467	17,204,997	43,012	959,533	18,959,542	13,950,000	4,650,000	18,600,000	392,618
	39	381,028,813	952,572	2,791,428	17,204,997	43,012	952,572	18,973,581	13,950,000	4,650,000	18,600,000	399,599
	40	378,237,385	945,593	2,798,407	17,204,997	43,012	945,593	18,987,603	13,950,000	4,650,000	18,600,000	406,597
	41	375,438,978	938,597	2,805,403	17,204,997	43,012	938,597	18,996,607	13,950,000	4,650,000	18,600,000	413,613
	42	372,633,576	931,584	2,812,416	17,204,997	43,012	931,584	19,005,593	13,950,000	4,650,000	18,600,000	420,647
	43	369,821,160	924,553	2,819,447	17,204,997	43,012	924,553	19,014,562	13,950,000	4,650,000	18,600,000	427,698
	44	367,001,712	917,504	2,826,496	17,204,997	43,012	917,504	19,023,513	13,950,000	4,650,000	18,600,000	434,767
	45	364,175,217	910,438	2,833,562	17,204,997	43,012	910,438	19,032,447	13,950,000	4,650,000	18,600,000	441,853
	46	361,341,655	903,354	2,840,646	17,204,997	43,012	903,354	19,041,363	13,950,000	4,650,000	18,600,000	448,957
	47	358,501,009	896,253	2,847,747	17,204,997	43,012	896,253	19,050,263	13,950,000	4,650,000	18,600,000	456,078
	48	355,653,261	889,133	2,854,867	17,204,997	43,012	889,133	19,059,142	13,950,000	4,650,000	18,600,000	463,215
5	49	352,798,395	881,996	2,862,004	17,204,997	43,012	881,996	19,068,005	13,950,000	4,650,000	18,600,000	469,995
	50	349,936,391	874,841	2,869,159	17,204,997	43,012	874,841	19,076,850	13,950,000	4,650,000	18,600,000	477,150
	51	347,067,232	867,668	2,876,332	17,204,997	43,012	867,668	19,085,677	13,950,000	4,650,000	18,600,000	484,323
	52	344,190,900	860,477	2,883,523	17,204,997	43,012	860,477	19,094,486	13,950,000	4,650,000	18,600,000	491,514
	53	341,307,377	853,268	2,890,732	17,204,997	43,012	853,268	19,103,278	13,950,000	4,650,000	18,600,000	498,722
	54	338,416,645	846,042	2,897,958	17,204,997	43,012	846,042	19,112,051	13,950,000	4,650,000	18,600,000	505,949
	55	335,518,687	838,797	2,905,203	17,204,997	43,012	838,797	19,120,806	13,950,000	4,650,000	18,600,000	513,194
	56	332,613,484	831,534	2,912,466	17,204,997	43,012	831,534	19,129,543	13,950,000	4,650,000	18,600,000	520,457
	57	329,701,017	824,253	2,919,747	17,204,997	43,012	824,253	19,138,262	13,950,000	4,650,000	18,600,000	527,738
	58	326,781,270	816,953	2,927,047	17,204,997	43,012	816,953	19,146,964	13,950,000	4,650,000	18,600,000	535,038
	59	323,854,223	809,636	2,934,364	17,204,997	43,012	809,636	19,155,645	13,950,000	4,650,000	18,600,000	542,353
	60	320,919,859	802,300	2,941,700	17,204,997	43,012	802,300	19,164,309	13,950,000	4,650,000	18,600,000	549,691
6	61	317,978,158	794,945	2,949,055	17,204,997	43,012	794,945	19,172,953	13,950,000	4,650,000	18,600,000	557,053
	62	315,029,104	787,573	2,956,427	17,204,997	43,012	787,573	19,181,582	13,950,000	4,650,000	18,600,000	564,438
	63	312,072,676	780,182	2,963,818	17,204,997	43,012	780,182	19,190,191	13,950,000	4,650,000	18,600,000	571,849
	64	309,108,858	772,772	2,971,228	17,204,997	43,012	772,772	19,198,781	13,950,000	4,650,000	18,600,000	579,279
	65	306,137,630	765,344	2,978,656	17,204,997	43,012	765,344	19,207,349	13,950,000	4,650,000	18,600,000	586,727
	66	303,158,974	757,897	2,986,103	17,204,997	43,012	757,897	19,215,907	13,950,000	4,650,000	18,600,000	594,193
	67	300,172,872	750,432	2,993,568	17,204,997	43,012	750,432	19,224,448	13,950,000	4,650,000	18,600,000	601,679
	68	297,179,304	742,948	2,001,052	17,204,997	43,012	742,948	19,232,975	13,950,000			

7	78	266,828,908	667,072	3,076,928	17,204,997	43,012	667,072	17,915,081	13,950,000	4,650,000	18,600,000	684,919
	79	263,751,980	659,380	3,084,620	17,204,997	43,012	659,380	17,907,389	13,950,000	4,650,000	18,600,000	692,611
	80	260,667,360	651,668	3,092,332	17,204,997	43,012	651,668	17,899,678	13,950,000	4,650,000	18,600,000	700,322
	81	257,575,028	643,938	3,100,062	17,204,997	43,012	643,938	17,891,947	13,950,000	4,650,000	18,600,000	708,053
	82	254,474,966	636,187	3,107,813	17,204,997	43,012	636,187	17,884,197	13,950,000	4,650,000	18,600,000	715,803
	83	251,364,153	628,418	3,115,582	17,204,997	43,012	628,418	17,876,427	13,950,000	4,650,000	18,600,000	723,573
	84	248,251,571	620,629	3,123,371	17,204,997	43,012	620,629	17,868,648	13,950,000	4,650,000	18,600,000	731,362
	85	245,138,200	612,821	3,131,179	17,204,997	43,012	612,821	17,860,330	13,950,000	4,650,000	18,600,000	739,170
	86	242,025,021	604,993	3,139,007	17,204,997	43,012	604,993	17,852,002	13,950,000	4,650,000	18,600,000	746,998
	87	238,908,013	597,145	3,146,855	17,204,997	43,012	597,145	17,843,154	13,950,000	4,650,000	18,600,000	754,846
	88	235,791,158	589,278	3,154,722	17,204,997	43,012	589,278	17,834,287	13,950,000	4,650,000	18,600,000	762,713
	89	232,666,436	581,391	3,162,609	17,204,997	43,012	581,391	17,825,494	13,950,000	4,650,000	18,600,000	770,600
	90	229,543,827	573,485	3,170,515	17,204,997	43,012	573,485	17,816,621	13,950,000	4,650,000	18,600,000	778,506
	91	226,423,312	565,558	3,178,442	17,204,997	43,012	565,558	17,807,767	13,950,000	4,650,000	18,600,000	786,433
	92	223,304,870	557,612	3,186,388	17,204,997	43,012	557,612	17,798,931	13,950,000	4,650,000	18,600,000	794,379
	93	219,188,482	549,646	3,194,354	17,204,997	43,012	549,646	17,790,113	13,950,000	4,650,000	18,600,000	802,345
	94	216,064,128	541,660	3,202,340	17,204,997	43,012	541,660	17,781,664	13,950,000	4,650,000	18,600,000	810,331
	95	212,941,789	533,654	3,210,346	17,204,997	43,012	533,654	17,773,338	13,950,000	4,650,000	18,600,000	818,336
	96	209,820,443	525,629	3,218,371	17,204,997	43,012	525,629	17,765,092	13,950,000	4,650,000	18,600,000	826,362
	97	206,701,072	517,583	3,226,417	17,204,997	43,012	517,583	17,756,816	13,950,000	4,650,000	18,600,000	834,408
	98	203,586,654	509,517	3,234,481	17,204,997	43,012	509,517	17,748,526	13,950,000	4,650,000	18,600,000	842,474
	99	200,472,171	501,430	3,242,570	17,204,997	43,012	501,430	17,740,440	13,950,000	4,650,000	18,600,000	850,560
	100	197,357,601	493,324	3,250,676	17,204,997	43,012	493,324	17,732,206	13,950,000	4,650,000	18,600,000	858,667
	101	194,242,925	485,197	3,258,803	17,204,997	43,012	485,197	17,724,099	13,950,000	4,650,000	18,600,000	866,794
	102	191,128,123	477,050	3,266,950	17,204,997	43,012	477,050	17,716,021	13,950,000	4,650,000	18,600,000	874,941
	103	188,013,573	468,883	3,275,117	17,204,997	43,012	468,883	17,707,974	13,950,000	4,650,000	18,600,000	883,108
	104	184,898,056	460,695	3,283,305	17,204,997	43,012	460,695	17,700,046	13,950,000	4,650,000	18,600,000	891,296
	105	181,782,531	452,487	3,291,513	17,204,997	43,012	452,487	17,692,267	13,950,000	4,650,000	18,600,000	899,504
	106	178,667,006	444,258	3,299,742	17,204,997	43,012	444,258	17,684,618	13,950,000	4,650,000	18,600,000	907,733
	107	175,551,481	436,009	3,307,991	17,204,997	43,012	436,009	17,676,748	13,950,000	4,650,000	18,600,000	915,982
	108	172,435,956	427,739	3,316,261	17,204,997	43,012	427,739	17,668,839	13,950,000	4,650,000	18,600,000	924,252
	109	169,320,431	419,448	3,324,552	17,204,997	43,012	419,448	17,660,859	13,950,000	4,650,000	18,600,000	932,543
	110	166,204,906	411,137	3,332,863	17,204,997	43,012	411,137	17,652,899	13,950,000	4,650,000	18,600,000	940,854
	111	163,089,381	402,805	3,341,195	17,204,997	43,012	402,805	17,644,961	13,950,000	4,650,000	18,600,000	949,186
	112	159,973,856	394,452	3,349,548	17,204,997	43,012	394,452	17,637,043	13,950,000	4,650,000	18,600,000	957,539
	113	156,858,331	386,078	3,357,922	17,204,997	43,012	386,078	17,629,146	13,950,000	4,650,000	18,600,000	965,913
	114	153,742,806	377,683	3,366,317	17,204,997	43,012	377,683	17,621,269	13,950,000	4,650,000	18,600,000	974,308
	115	150,627,281	369,267	3,374,733	17,204,997	43,012	369,267	17,613,411	13,950,000	4,650,000	18,600,000	982,724
	116	147,511,756	360,830	3,383,170	17,204,997	43,012	360,830	17,605,572	13,950,000	4,650,000	18,600,000	991,161
	117	144,396,231	352,372	3,391,628	17,204,997	43,012	352,372	17,597,752	13,950,000	4,650,000	18,600,000	999,618
	118	141,280,706	343,893	3,400,107	17,204,997	43,012	343,893	17,589,951	13,950,000	4,650,000	18,600,000	1,008,098
	119	138,165,181	335,393	3,408,607	17,204,997	43,012	335,393	17,582,169	13,950,000	4,650,000	18,600,000	1,016,598
	120	135,049,656	326,872	3,417,128	17,204,997	43,012	326,872	17,574,406	13,950,000	4,650,000	18,600,000	1,025,119
	121	131,934,131	318,329	3,425,671	17,204,997	43,012	318,329	17,566,663	13,950,000	4,650,000	18,600,000	1,033,662
	122	128,818,606	309,765	3,434,235	17,204,997	43,012	309,765	17,558,939	13,950,000	4,650,000	18,600,000	1,042,226
	123	125,703,081	301,179	3,442,821	17,204,997	43,012	301,179	17,551,234	13,950,000	4,650,000	18,600,000	1,050,811
	124	122,587,556	292,572	3,451,428	17,204,997	43,012	292,572	17,543,547	13,950,000	4,650,000	18,600,000	1,059,419
	125	119,472,031	283,943	3,460,057	17,204,997	43,012	283,943	17,535,877	13,950,000	4,650,000	18,600,000	1,068,048
	126	116,356,506	275,293	3,468,707	17,204,997	43,012	275,293	17,528,224	13,950,000	4,650,000	18,600,000	1,076,698
	127	113,240,981	266,621	3,477,379	17,204,997	43,012	266,621	17,520,587	13,950,000	4,650,000	18,600,000	1,085,369
	128	110,125,456	257,928	3,486,072	17,204,997	43,012	257,928	17,512,966	13,950,000	4,650,000	18,600,000	1,094,062
	129	107,009,931	249,213	3,494,787	17,204,997	43,012	249,213	17,505,361	13,950,000	4,650,000	18,600,000	1,102,778
	130	103,894,406	240,476	3,503,524	17,204,997	43,012	240,476	17,497,772	13,950,000	4,650,000	18,600,000	1,111,515
	131	100,778,881	231,717	3,512,283	17,204,997	43,012	231,717	17,490,206	13,950,000	4,650,000	18,600,000	1,120,274
	132	97,663,356	222,936	3,521,064	17,204,997	43,012	222,936	17,482,654	13,950,000	4,650,000	18,600,000	1,129,053
	133	94,547,831	214,134	3,529,866	17,204,997	43,012	214,134	17,475,116	13,950,000	4,650,000	18,600,000	1,137,857
	134	91,432,306	205,309	3,538,691	17,204,997	43,012	205,309	17,467,591	13,950,000	4,650,000	18,600,000	1,146,682
	135	88,316,781	196,462	3,547,538	17,204,997	43,012	196,462	17,460,079	13,950,000	4,650,000	18,600,000	1,155,529
	136	85,201,256	187,593	3,556,407	17,204,997	43,012	187,593	17,452,579	13,950,000	4,650,000	18,600,000	1,164,397
	137	82,085,731	178,702	3,565,298	17,204,997	43,012	178,702	17,445,091	13,950,000	4,650,000	18,600,000	1,173,288
	138	78,970,206	169,789	3,574,211	17,204,997	43,012	169,789	17,437,616	13,950,000	4,650,000	18,600,000	1,182,202
	139	75,854,681	160,854	3,583,146	17,204,997	43,012	160,854	17,430,154	13,950,000	4,650,000	18,600,000	1,191,137
	140	72,739,156	151,896	3,592,104	17,204,997	43,012	151,896	17,422,704	13,950,000	4,650,000	18,600,000	1,200,093
	141	69,623,631	142,915	3,601,085	17,204,997	43,012	142,915	17,415,266	13,950,000	4,650,000	18,600,000	1,209,078
	142	66,508,106	133,913	3,610,087	17,204,997	43,012	133,913	17,407,839	13,950,000	4,650,000	18,600,000	1,218,093
	143	63,392,581	124,888	3,619,112	17,204,997	43,012	124,888	17,400,424	13,950,000	4,650,000	18,600,000	1,227,138
	144	60,277,056	115,840	3,628,160	17,204,997	43,012	115,840	17,393,021	13,950,000	4,650,000	18,600,000	1,236,213
	145	57,161,531	106,769	3,637,231	17,204,997	43,012	106,769	17,385,630	13,950,000	4,650,000	18,600,000	1,245,318
	146	54,046,006	97,676	3,646,324	17,204,997	43,012	97,676	17,378,251	13,950,000	4,650,000	18,600,000	1,254,453
	147	50,930,481	88,560	3,655,440	17,204,997	43,012	88,560	17,370,883	13,950,000	4,650,000	18,600,000	1,263,618
	148	47,814,956	79,422	3,664,577	17,204,997	43,012	79,422	17,363,526	13,950,000	4,650,000	18,600,000	1,272,803
	149	44,699,431	70,260	3,673,734	17,204,997	43,012	70,260	17,356,180	13,950,000	4,650,000	18,600,000	1,282,008
	150	41,583,906	61,076	3,682,914	17,204,997	43,012	61,076	17,348,845	13,950,000	4,650,000	18,600,000	1,291,233
	151	38,468,381	51,869	3,692,117	17,204,997	43,0						

Appendix - Table 9. Monthly accounts of production cost of P₂O₅ by a fuel method (Annual output of phosphate=120,000 tons, Gross margin of ore=10 %, Interest rate=3.0 %; Private power supply).

Invested capital: 566,100,000		Annual depreciation: 50,528,000		Price of phosphate ore, Rs. 1,334/ton		Initial gross margin: -0.11 %						
Private power supply		Annual interest rate: 3.0 %		Production cost: Rs.3,604/ton		Total gross margin: 3.55 %						
Year	Month	Loan balance	Monthly interest (3.0%/12)	Refunded principal	Direct production costs	Interest on working capital	Interest on depreciation	Total production costs	Proceeds (Rs.2700 ton)	Government subsidy (Rs.900 ton)	Revenues	Profit and loss
1	1	566,100,000	1,415,250	2,795,417	17,163,169	42,908	1,415,250	18,621,327	13,950,000	4,650,000	18,600,000	-21,327
	2	563,304,583	1,408,261	2,802,405	17,163,169	42,908	1,408,261	18,614,338	13,950,000	4,650,000	18,600,000	-14,338
	3	560,502,178	1,401,255	2,809,411	17,163,169	42,908	1,401,255	18,607,332	13,950,000	4,650,000	18,600,000	-7,332
	4	557,692,767	1,394,232	2,816,435	17,163,169	42,908	1,394,232	18,600,309	13,950,000	4,650,000	18,600,000	-309
	5	554,876,332	1,387,191	2,823,476	17,163,169	42,908	1,387,191	18,593,268	13,950,000	4,650,000	18,600,000	6,732
	6	552,052,856	1,380,132	2,830,535	17,163,169	42,908	1,380,132	18,586,209	13,950,000	4,650,000	18,600,000	13,791
	7	549,222,322	1,373,056	2,837,611	17,163,169	42,908	1,373,056	18,579,133	13,950,000	4,650,000	18,600,000	20,867
	8	546,384,711	1,365,962	2,844,705	17,163,169	42,908	1,365,962	18,572,039	13,950,000	4,650,000	18,600,000	27,961
	9	543,540,006	1,358,850	2,851,817	17,163,169	42,908	1,358,850	18,564,927	13,950,000	4,650,000	18,600,000	35,073
	10	540,688,189	1,351,720	2,858,946	17,163,169	42,908	1,351,720	18,557,797	13,950,000	4,650,000	18,600,000	42,203
	11	537,829,243	1,344,573	2,866,094	17,163,169	42,908	1,344,573	18,550,650	13,950,000	4,650,000	18,600,000	49,350
	12	534,963,150	1,337,408	2,873,259	17,163,169	42,908	1,337,408	18,543,485	13,950,000	4,650,000	18,600,000	56,515
2	13	532,089,891	1,330,225	2,880,442	17,163,169	42,908	1,330,225	18,536,302	13,950,000	4,650,000	18,600,000	63,696
	14	529,209,449	1,323,024	2,887,643	17,163,169	42,908	1,323,024	18,529,101	13,950,000	4,650,000	18,600,000	70,899
	15	526,321,806	1,315,805	2,894,862	17,163,169	42,908	1,315,805	18,521,881	13,950,000	4,650,000	18,600,000	78,119
	16	523,426,944	1,308,567	2,902,099	17,163,169	42,908	1,308,567	18,514,644	13,950,000	4,650,000	18,600,000	85,356
	17	520,524,844	1,301,312	2,909,355	17,163,169	42,908	1,301,312	18,507,389	13,950,000	4,650,000	18,600,000	92,611
	18	517,615,490	1,294,039	2,916,628	17,163,169	42,908	1,294,039	18,500,116	13,950,000	4,650,000	18,600,000	99,884
	19	514,698,862	1,286,747	2,923,920	17,163,169	42,908	1,286,747	18,492,824	13,950,000	4,650,000	18,600,000	107,175
	20	511,774,942	1,279,437	2,931,229	17,163,169	42,908	1,279,437	18,485,514	13,950,000	4,650,000	18,600,000	114,486
	21	508,843,713	1,272,109	2,938,557	17,163,169	42,908	1,272,109	18,478,186	13,950,000	4,650,000	18,600,000	121,814
	22	505,903,156	1,264,763	2,945,904	17,163,169	42,908	1,264,763	18,470,840	13,950,000	4,650,000	18,600,000	129,160
	23	502,959,252	1,257,398	2,953,269	17,163,169	42,908	1,257,398	18,463,475	13,950,000	4,650,000	18,600,000	136,523
	24	500,005,983	1,250,015	2,960,652	17,163,169	42,908	1,250,015	18,456,092	13,950,000	4,650,000	18,600,000	143,908
3	25	497,043,332	1,242,613	2,968,053	17,163,169	42,908	1,242,613	18,448,690	13,950,000	4,650,000	18,600,000	151,310
	26	494,077,278	1,235,193	2,975,473	17,163,169	42,908	1,235,193	18,441,270	13,950,000	4,650,000	18,600,000	158,730
	27	491,101,805	1,227,755	2,982,912	17,163,169	42,908	1,227,755	18,433,831	13,950,000	4,650,000	18,600,000	166,169
	28	488,118,813	1,220,297	2,990,369	17,163,169	42,908	1,220,297	18,426,374	13,950,000	4,650,000	18,600,000	173,626
	29	485,128,523	1,212,821	2,997,843	17,163,169	42,908	1,212,821	18,418,898	13,950,000	4,650,000	18,600,000	181,102
	30	482,130,678	1,205,327	3,005,340	17,163,169	42,908	1,205,327	18,411,404	13,950,000	4,650,000	18,600,000	188,596
	31	479,125,338	1,197,813	3,012,853	17,163,169	42,908	1,197,813	18,403,890	13,950,000	4,650,000	18,600,000	196,110
	32	476,112,485	1,190,281	3,020,383	17,163,169	42,908	1,190,281	18,396,358	13,950,000	4,650,000	18,600,000	203,642
	33	473,092,029	1,182,730	3,027,936	17,163,169	42,908	1,182,730	18,388,807	13,950,000	4,650,000	18,600,000	211,193
	34	470,064,163	1,175,160	3,035,506	17,163,169	42,908	1,175,160	18,381,237	13,950,000	4,650,000	18,600,000	218,763
	35	467,028,656	1,167,572	3,043,095	17,163,169	42,908	1,167,572	18,373,649	13,950,000	4,650,000	18,600,000	226,351
	36	463,983,561	1,159,964	3,050,703	17,163,169	42,908	1,159,964	18,366,041	13,950,000	4,650,000	18,600,000	233,959
4	37	460,934,899	1,152,337	3,058,330	17,163,169	42,908	1,152,337	18,358,414	13,950,000	4,650,000	18,600,000	241,586
	38	457,879,579	1,144,691	3,065,975	17,163,169	42,908	1,144,691	18,350,768	13,950,000	4,650,000	18,600,000	249,232
	39	454,810,554	1,137,026	3,073,640	17,163,169	42,908	1,137,026	18,343,103	13,950,000	4,650,000	18,600,000	256,897
	40	451,736,914	1,129,344	3,081,324	17,163,169	42,908	1,129,344	18,335,419	13,950,000	4,650,000	18,600,000	264,581
	41	448,658,569	1,121,639	3,089,028	17,163,169	42,908	1,121,639	18,327,716	13,950,000	4,650,000	18,600,000	272,284
	42	445,566,561	1,113,916	3,096,750	17,163,169	42,908	1,113,916	18,319,993	13,950,000	4,650,000	18,600,000	280,007
	43	442,469,811	1,106,175	3,104,492	17,163,169	42,908	1,106,175	18,312,251	13,950,000	4,650,000	18,600,000	287,749
	44	439,365,319	1,098,413	3,112,253	17,163,169	42,908	1,098,413	18,304,490	13,950,000	4,650,000	18,600,000	295,510
	45	436,262,066	1,090,633	3,120,034	17,163,169	42,908	1,090,633	18,296,710	13,950,000	4,650,000	18,600,000	303,290
	46	433,153,032	1,082,833	3,127,834	17,163,169	42,908	1,082,833	18,288,910	13,950,000	4,650,000	18,600,000	311,090
	47	430,035,198	1,075,013	3,135,654	17,163,169	42,908	1,075,013	18,281,090	13,950,000	4,650,000	18,600,000	318,910
	48	426,914,541	1,067,174	3,143,493	17,163,169	42,908	1,067,174	18,273,251	13,950,000	4,650,000	18,600,000	326,749
5	49	423,786,051	1,059,315	3,151,352	17,163,169	42,908	1,059,315	18,265,392	13,950,000	4,650,000	18,600,000	334,608
	50	420,647,700	1,051,437	3,159,230	17,163,169	42,908	1,051,437	18,257,514	13,950,000	4,650,000	18,600,000	342,484
	51	417,500,473	1,043,539	3,167,128	17,163,169	42,908	1,043,539	18,249,616	13,950,000	4,650,000	18,600,000	350,384
	52	414,348,342	1,035,621	3,175,046	17,163,169	42,908	1,035,621	18,241,698	13,950,000	4,650,000	18,600,000	358,302
	53	411,179,296	1,027,683	3,182,983	17,163,169	42,908	1,027,683	18,233,760	13,950,000	4,650,000	18,600,000	366,240
	54	408,006,312	1,019,726	3,190,941	17,163,169	42,908	1,019,726	18,225,803	13,950,000	4,650,000	18,600,000	374,197
	55	404,826,372	1,011,748	3,198,918	17,163,169	42,908	1,011,748	18,217,825	13,950,000	4,650,000	18,600,000	382,175
	56	401,639,453	1,003,751	3,206,916	17,163,169	42,908	1,003,751	18,209,828	13,950,000	4,650,000	18,600,000	390,172
	57	398,445,538	995,734	3,214,933	17,163,169	42,908	995,734	18,201,811	13,950,000	4,650,000	18,600,000	398,189
	58	395,244,605	987,697	3,222,970	17,163,169	42,908	987,697	18,193,773	13,950,000	4,650,000	18,600,000	406,227
	59	392,037,635	979,639	3,231,028	17,163,169	42,908	979,639	18,185,716	13,950,000	4,650,000	18,600,000	414,284
	60	388,824,607	971,562	3,239,105	17,163,169	42,908	971,562	18,177,638	13,950,000	4,650,000	18,600,000	422,362
6	61	385,605,502	963,464	3,247,203	17,163,169	42,908	963,464	18,169,541	13,950,000	4,650,000	18,600,000	430,459
	62	382,379,299	955,346	3,255,321	17,163,169	42,908	955,346	18,161,423	13,950,000	4,650,000	18,600,000	438,577
	63	379,146,978	947,207	3,263,459	17,163,169	42,908	947,207	18,153,284	13,950,000	4,650,000	18,600,000	446,716
	64	375,907,519	939,049	3,271,618	17,163,169	42,908	939,049	18,145,126	13,950,000	4,650,000	18,600,000	454,874
	65	372,661,901	930,870	3,279,797	17,163,169	42,908	930,870	18,136,947	13,950,000	4,650,000	18,600,000	463,053
	66	369,408,104	922,670	3,287,996	17,163,169	42,908	922,670	18,128,747	13,950,000	4,650,000	18,600,000	471,253
	67	366,152,108	914,450	3,296,216	17,163,169	42,908	914,450	18,120,527	13,950,000	4,650,000	18,600,000	479,473
	68	362										

80	322,560,604	805,702	3,404,965	17,163,169	42,908	805,702	18,011,778	13,950,000	+6,500,000	18,600,000	588,222
81	318,875,538	797,189	3,413,478	17,163,169	42,908	797,189	18,003,266	13,950,000	+6,500,000	18,600,000	596,734
82	315,462,161	788,655	3,422,011	17,163,169	42,908	788,655	17,994,732	13,950,000	+6,500,000	18,600,000	605,268
83	312,040,150	780,100	3,430,566	17,163,169	42,908	780,100	17,986,177	13,950,000	+6,500,000	18,600,000	613,823
84	308,609,963	771,524	3,439,143	17,163,169	42,908	771,524	17,977,601	13,950,000	+6,500,000	18,600,000	622,379
85	305,170,441	762,926	3,447,741	17,163,169	42,908	762,926	17,969,003	13,950,000	+6,500,000	18,600,000	630,927
86	301,722,700	754,307	3,456,360	17,163,169	42,908	754,307	17,960,384	13,950,000	+6,500,000	18,600,000	639,466
87	298,284,340	745,666	3,465,001	17,163,169	42,908	745,666	17,951,743	13,950,000	+6,500,000	18,600,000	648,257
88	294,841,339	737,003	3,473,663	17,163,169	42,908	737,003	17,943,080	13,950,000	+6,500,000	18,600,000	656,920
89	291,397,676	728,319	3,482,347	17,163,169	42,908	728,319	17,934,396	13,950,000	+6,500,000	18,600,000	665,604
90	287,945,328	719,613	3,491,053	17,163,169	42,908	719,613	17,925,690	13,950,000	+6,500,000	18,600,000	674,310
91	284,493,275	710,886	3,499,781	17,163,169	42,908	710,886	17,916,963	13,950,000	+6,500,000	18,600,000	683,037
92	281,041,254	702,136	3,508,530	17,163,169	42,908	702,136	17,908,213	13,950,000	+6,500,000	18,600,000	691,787
93	277,589,964	693,363	3,517,302	17,163,169	42,908	693,363	17,899,442	13,950,000	+6,500,000	18,600,000	700,558
94	274,138,662	684,572	3,526,095	17,163,169	42,908	684,572	17,890,699	13,950,000	+6,500,000	18,600,000	709,351
95	270,687,567	675,756	3,534,910	17,163,169	42,908	675,756	17,881,833	13,950,000	+6,500,000	18,600,000	718,167
96	267,236,657	666,919	3,543,748	17,163,169	42,908	666,919	17,872,996	13,950,000	+6,500,000	18,600,000	727,004
97	263,785,900	658,060	3,552,607	17,163,169	42,908	658,060	17,864,137	13,950,000	+6,500,000	18,600,000	735,863
98	259,335,302	649,178	3,561,488	17,163,169	42,908	649,178	17,855,255	13,950,000	+6,500,000	18,600,000	744,749
99	255,884,814	640,275	3,570,392	17,163,169	42,908	640,275	17,846,351	13,950,000	+6,500,000	18,600,000	753,649
100	252,434,422	631,349	3,579,318	17,163,169	42,908	631,349	17,837,425	13,950,000	+6,500,000	18,600,000	762,575
101	248,984,104	622,400	3,588,266	17,163,169	42,908	622,400	17,828,477	13,950,000	+6,500,000	18,600,000	771,521
102	245,533,837	613,430	3,597,237	17,163,169	42,908	613,430	17,819,507	13,950,000	+6,500,000	18,600,000	780,491
103	242,083,520	604,437	3,606,230	17,163,169	42,908	604,437	17,810,513	13,950,000	+6,500,000	18,600,000	789,487
104	238,633,253	595,421	3,615,246	17,163,169	42,908	595,421	17,801,498	13,950,000	+6,500,000	18,600,000	798,502
105	235,183,000	586,383	3,624,284	17,163,169	42,908	586,383	17,792,460	13,950,000	+6,500,000	18,600,000	807,540
106	231,732,747	577,322	3,633,345	17,163,169	42,908	577,322	17,783,399	13,950,000	+6,500,000	18,600,000	816,601
107	228,282,494	568,239	3,642,428	17,163,169	42,908	568,239	17,774,316	13,950,000	+6,500,000	18,600,000	825,684
108	224,832,241	559,133	3,651,534	17,163,169	42,908	559,133	17,765,210	13,950,000	+6,500,000	18,600,000	834,790
109	221,381,988	550,000	3,660,663	17,163,169	42,908	550,000	17,756,081	13,950,000	+6,500,000	18,600,000	843,919
110	217,931,735	540,852	3,669,814	17,163,169	42,908	540,852	17,746,929	13,950,000	+6,500,000	18,600,000	853,071
111	214,481,482	531,678	3,678,989	17,163,169	42,908	531,678	17,737,753	13,950,000	+6,500,000	18,600,000	862,245
112	211,031,229	522,480	3,688,186	17,163,169	42,908	522,480	17,728,557	13,950,000	+6,500,000	18,600,000	871,441
113	207,580,976	513,260	3,697,407	17,163,169	42,908	513,260	17,719,337	13,950,000	+6,500,000	18,600,000	880,663
114	204,130,723	504,016	3,706,650	17,163,169	42,908	504,016	17,710,090	13,950,000	+6,500,000	18,600,000	889,917
115	200,680,470	494,750	3,715,917	17,163,169	42,908	494,750	17,700,826	13,950,000	+6,500,000	18,600,000	899,194
116	197,230,217	485,460	3,725,207	17,163,169	42,908	485,460	17,691,537	13,950,000	+6,500,000	18,600,000	908,463
117	193,780,000	476,147	3,734,520	17,163,169	42,908	476,147	17,682,224	13,950,000	+6,500,000	18,600,000	917,776
118	190,329,747	466,810	3,743,856	17,163,169	42,908	466,810	17,672,887	13,950,000	+6,500,000	18,600,000	927,113
119	186,879,494	457,451	3,753,216	17,163,169	42,908	457,451	17,663,528	13,950,000	+6,500,000	18,600,000	936,477
120	183,429,241	448,068	3,762,599	17,163,169	42,908	448,068	17,654,145	13,950,000	+6,500,000	18,600,000	945,853
121	179,978,988	438,661	3,772,005	17,163,169	42,908	438,661	17,644,738	13,950,000	+6,500,000	18,600,000	955,262
122	176,528,735	429,231	3,781,435	17,163,169	42,908	429,231	17,635,308	13,950,000	+6,500,000	18,600,000	964,692
123	173,078,482	419,778	3,790,889	17,163,169	42,908	419,778	17,625,855	13,950,000	+6,500,000	18,600,000	974,145
124	169,628,229	410,300	3,800,366	17,163,169	42,908	410,300	17,616,377	13,950,000	+6,500,000	18,600,000	983,623
125	166,177,976	400,800	3,809,867	17,163,169	42,908	400,800	17,606,876	13,950,000	+6,500,000	18,600,000	993,124
126	162,727,723	391,275	3,819,392	17,163,169	42,908	391,275	17,597,352	13,950,000	+6,500,000	18,600,000	1,002,648
127	159,277,470	381,724	3,828,940	17,163,169	42,908	381,724	17,587,803	13,950,000	+6,500,000	18,600,000	1,012,197
128	155,827,217	372,154	3,838,513	17,163,169	42,908	372,154	17,578,231	13,950,000	+6,500,000	18,600,000	1,021,768
129	152,376,964	362,558	3,848,109	17,163,169	42,908	362,558	17,568,635	13,950,000	+6,500,000	18,600,000	1,031,365
130	148,926,711	352,937	3,857,729	17,163,169	42,908	352,937	17,559,014	13,950,000	+6,500,000	18,600,000	1,040,986
131	145,476,458	343,293	3,867,374	17,163,169	42,908	343,293	17,549,370	13,950,000	+6,500,000	18,600,000	1,050,633
132	142,026,205	333,625	3,877,042	17,163,169	42,908	333,625	17,539,702	13,950,000	+6,500,000	18,600,000	1,060,298
133	138,575,952	323,932	3,886,735	17,163,169	42,908	323,932	17,530,009	13,950,000	+6,500,000	18,600,000	1,069,991
134	135,125,699	314,215	3,896,451	17,163,169	42,908	314,215	17,520,292	13,950,000	+6,500,000	18,600,000	1,079,708
135	131,675,446	304,474	3,906,190	17,163,169	42,908	304,474	17,510,551	13,950,000	+6,500,000	18,600,000	1,089,449
136	128,225,193	294,709	3,915,958	17,163,169	42,908	294,709	17,500,786	13,950,000	+6,500,000	18,600,000	1,099,214
137	124,774,940	284,919	3,925,748	17,163,169	42,908	284,919	17,490,996	13,950,000	+6,500,000	18,600,000	1,108,999
138	121,324,687	275,104	3,935,562	17,163,169	42,908	275,104	17,481,181	13,950,000	+6,500,000	18,600,000	1,118,819
139	117,874,434	265,266	3,945,401	17,163,169	42,908	265,266	17,471,342	13,950,000	+6,500,000	18,600,000	1,128,658
140	114,424,181	255,402	3,955,265	17,163,169	42,908	255,402	17,461,479	13,950,000	+6,500,000	18,600,000	1,138,521
141	110,973,928	245,514	3,965,153	17,163,169	42,908	245,514	17,451,591	13,950,000	+6,500,000	18,600,000	1,148,409
142	107,523,675	235,601	3,975,066	17,163,169	42,908	235,601	17,441,678	13,950,000	+6,500,000	18,600,000	1,158,322
143	104,073,422	225,663	3,984,966	17,163,169	42,908	225,663	17,431,740	13,950,000	+6,500,000	18,600,000	1,168,260
144	100,623,169	215,701	3,994,866	17,163,169	42,908	215,701	17,421,778	13,950,000	+6,500,000	18,600,000	1,178,222
145	97,172,916	205,713	4,004,783	17,163,169	42,908	205,713	17,411,790	13,950,000	+6,500,000	18,600,000	1,188,210
146	93,722,663	195,701	4,014,766	17,163,169	42,908	195,701	17,401,778	13,950,000	+6,500,000	18,600,000	1,198,222
147	90,272,410	185,664	4,024,773	17,163,169	42,908	185,664	17,391,740	13,950,000	+6,500,000	18,600,000	1,208,260
148	86,822,157	175,601	4,034,806	17,163,169	42,908	175,601	17,381,678	13,950,000	+6,500,000	18,600,000	1,218,322
149	83,371,904	165,511	4,044,863	17,163,169	42,908	165,511	17,371,590	13,950,000	+6,500,000	18,600,000	1,228,410
150	79,921,651	155,401	4,054,944	17,163,169	42,908	155,401	17,361,477	13,950,000	+6,500,000	18,600,000	1,238,523
151	76,471,398	145,262	4,065,046	17,163,169	42,908	145,262	17,351,339	13,950,000	+6,500,000	18,600,000	1,248,661
152	73,021,145	135,099	4,075,169	17,163,169	42,908	135,099	17,341,176	13,950,000	+6,500,000	18,600,000	1,258,823
153	69,570,892	124,910	4,085,311	17,163,169	42,908	124,910	17,330,992	13,950,000	+6,500,000	18,600,000	1,269,013
154	66,120,639	114,696	4,095,471	17,163,169	42,908	114,696	17,320,777	13,950,000	+6,500,000	18,600,000	1,279,228
155	62,670,386										