4－4．東部ジャワ研修旅行

目的　　同行専門家　高島　良哉

中堅技術者養成対策事業の一貫として、中核農民、行政的指導者等による先進地の視察を実施し、栽培技術、流通販売方法、協同組合活動等を、現地の農民との交流を通じて体得させようとするものである。

場所

東部ジャワ一円（行程　図－4）

月日

1994年1月25日～2月1日（8日間）

参加者

中核農民　6名、普及員　3名、行政責任者　6名、その他　4名、(表－16)

内容

(1) ジョンバング県(Kab.Jombang)

1）尿素団子(Urea Tablet)施用水田の見学(Supra insus program)

現在政府が推奨している窒素質肥料施用の一方法である。施用量は200kg/haで普通7～8 ton/haの収量がある。

2）水田の休憩所でクロンポック・タニ(Damai)と討論会

この地域が現在のように発展したのは、農民の努力もあるが普及員の指導によるところが大であった。それに比べ、わがプロジェクトサイトの普及員の活動内容について、相手側から見て不十分であることの意見があった。

その他肥料の具体的施用方法について質問していた。

3）協同組合(KUD)アヌグラ(Aungrah)訪問

この協同組合は、精米事情を中心に、牛乳集荷、サトウキビ集荷、肥料の販売、と日用品販売事業をしている。精米事業は、火力乾燥機を含めて4ユニットで2 ton/hrを処理している。その他集荷業務は、各農家から集荷して契約処理工場まで運ぶ事業である。

(2) パスルアン県(Kab.Pasuruan)

1）PT. Friga（果実苗木生産会社）訪問

この苗木生産会社の主な樹種は、マンゴ（80%）、その他ランブータン、アボガド等である。マンゴの場合、播種後3か月で接ぎ木し、その後販売可能まで約9か月である。接ぎ木の成功率は90%であるが、販売できるのは約70%位である。価格はRp. 1,500／本であるが、それに輸送費が入る。（クンダリまで輸送費Rp.1,500／本）

参加したラロバオ、ラプル、ラエヤの各農民から、是非村で育苗事業をやってみた

いので、JICAで援助して欲しいと要望があったので、可能な限り協力する旨を伝える。

2）作物種子処理供給センター

種子生産センターから集められた、水稲、トウモロコシ、なが豆等の種を選別、乾燥してパッキングして農家に販売している。選別、乾燥には何れも大型の機械によって処理されパッキングされている。特に感じたことは、場内が実に清潔にされており、他の種子の混入防止等に神経を使っているように思われた。

(3) マラング県(Kab.Malang)

1）乳牛飼養農家訪問

飼養技術は日本の戦後のようであったが、飼料は自給飼料が殆どの様で経営としては安定しているようであった。乳量は10ℓ／日／頭（1ℓRp.500）で少ないが、この農家の場合、成牛14頭、仔牛11頭飼養し、年間かなりの収益をあげている。また、糞尿処理に問題を感じたが、半分くらいは一か所に集めておけば、周囲の農家が野菜栽培用に採りにきて処理し、後は河川に流しているのが現状であった。牛乳の集荷は、KUDから毎日採りにきてくれる。

2）蘭及び盆栽園芸農家訪問

この農家の場合、盆栽を趣味で始めたのが蘭に発展して現在の規模になった。蘭の培養基、交配などここまで成長するには、努力がいったようである。盆栽の栽培については日本に青年を派遣して、技術の修得に努めている。

3）バツー協同組合

設立は、1978年4月26日で15年を経過した。組合の範囲は、3郡で組合員数は13,955名である。事業活動は現在13部門に亘っており、牛乳集荷加工処理、米の集荷、園芸関係の資材調達から販売、信用販売事業、運輸事業等に及び、これらは全て組合員の要望から拡大したものであり、組合員の行動の動機ずけとなっている。

しかし、これだけ大きな組織として運営するマネージャ、即ち組合長の月給はRp.40万と聞いたが、この辺が法律で規制されているのか少ないように思われた。

(4) ブリタル県(Kab.Blitar)

1）ココナッツ椰子による砂糖の生産

エステート事務所のカカオの展示圃内にある、被陰樹のココナッツ椰子から糖蜜を採取し、砂糖を生産する農民グループを訪問した。一本の椰子から0.3ℓ／日が採取され、1ℓの糖乳から500ｇの砂糖が生産される。（一回の鍋から20kgの砂糖が生産され、価格はkg当りRp.600である。）

当方の研修者が樹上で、採取方法を直接農民から教えられていた。

2）養鶏技術の改良

養鶏技術の改良に、集落ぐるみで取り組んでいるグループを訪問した。その内容は①雛鳥の育成　②ワクチン注射　③餌の改良　④ふ卵器の改良等に大きな成果をあげ養鶏専業農家も生まれている。また、村長自身が種々の品種の鶏を飼育し、チャボ等の小型種は鑑賞用として高価に売れるようである。

(5) ンガンジュク県(Kab.Nganjuk)

1）水管理組合と集落苗木生産グループ

この水管理組合は、管理、運営で1993年度州最高賞を授賞した。しかし10年前の組合発足当初は、組合の賦課金が集まらなく運営が危機に貧した。そこで考え出されたのが、クロンポックタニ毎のマンゴの苗木を生産して販売し、その代金の一部を賦課金として当てた。それが現在の生産グループとなり、農家の生産技術も向上して販売を伸ばしている。

2）肉牛・山羊肥育農家を訪問

ジャワ牛を肥育しているが、全て舎飼でかなりの濃厚飼料を与えている。粗飼料には乾燥を使用するとともに、敷き藁は堆肥として活用していた。一戸あたり5～6頭の飼育である。

ここで飼育している山羊は、高品質のもので一頭がRp.300,000するようである。

(6) 総　評

今回の研修旅行の出発に際し参加者に特に注意した点は、われわれが視察する地域、または農家はきっと立派な技術、立派な業績を挙げた農民のグループばかりであると思う。従って、それらの技術を細かに見聞きする事も大切であるが、彼らがここまで成長した過程、失敗した苦労話等を収集して、我が村の発展の芽を見いだして欲しい。また、高原地域でなければ成立しない農業技術を子細に聞いても余り意味がない。彼らがこの環境を生かした、知恵と努力をよく学んで、テナンゲア郡の何が可能であるかを考えるようにして欲しいことを強調した。

今回の研修の中で、行政担当者間では協同組合についてかなり意見が別れていたようである。それは、過去に協同組合で失敗した経験を引きずっているためと思われたが、それだから協同組合が全てダメとはいえないので、今回の立派な経営の協同組合を参考に地域のKUDを発展してもらいたいと思った。

研修の中間でみんなで討議した。その中で水稲の新品種の導入に話しが及んだとき、新品種の種子もさることながら、毎年の水稲の種子がなく富農から借りている。という切実な話しがでて、これでは技術以前の話しではないかと思った。

また、村で実施する育苗事業については、農民グループ1日研修があるので、そのさ

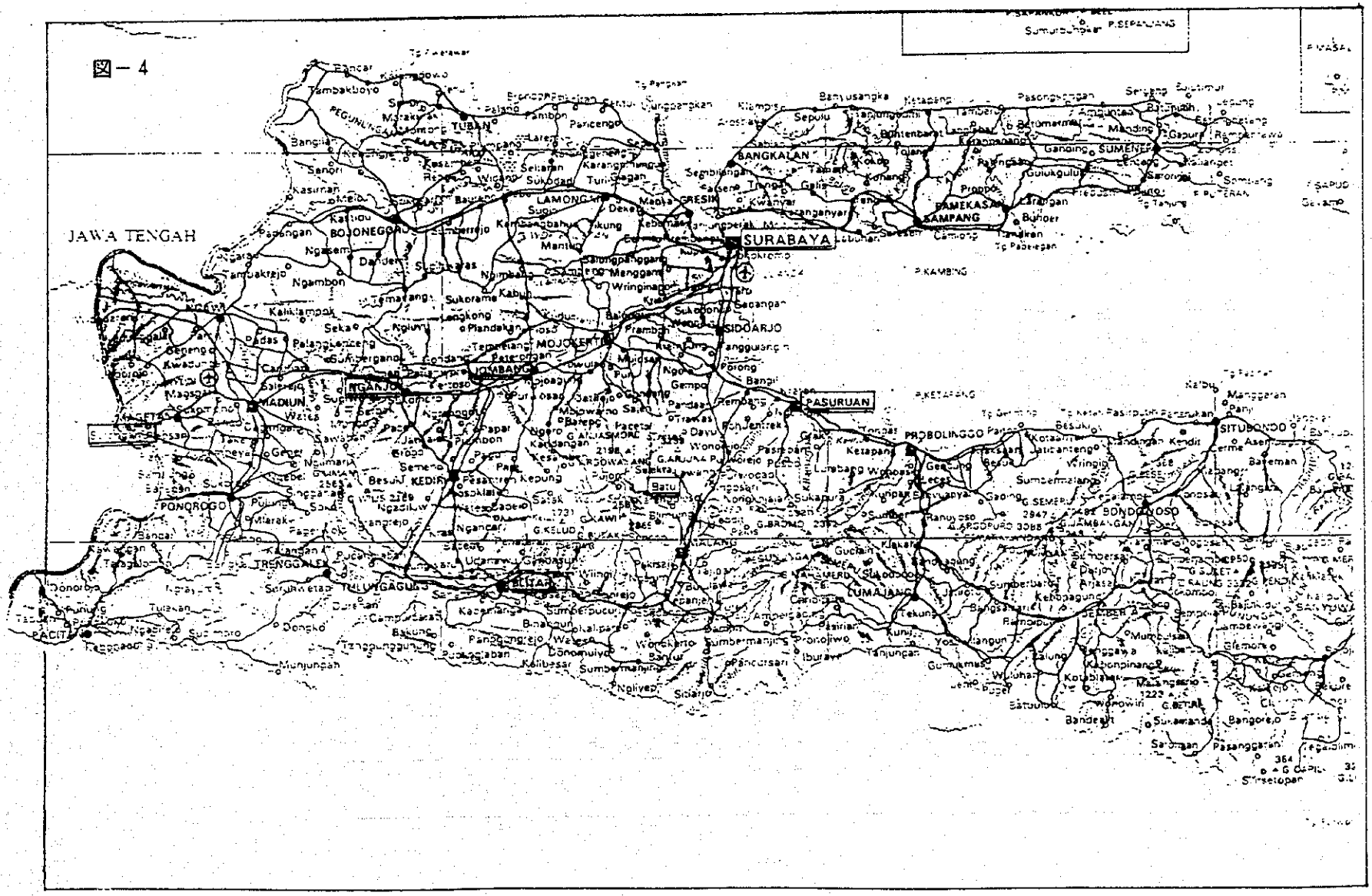
い講師とともに接ぎ木の母樹となる優良品種を供与することを伝えた。

今回旅行に参加した中核農民と村の組合員で、今回の見たこと、聞いたこと、経験したこと等をよく話し合って、その内容を郡帳に報告するようにした。

表－16　DAFTAR NAMA PESERTA STUDY TOUR KE JAWA TIMUR

No	NAMA PESERTA	KETERANGAN
1	Ir. Yusuf Yakub, M.Ed	Ka.Kanwil Deptan Sultra
2	Yoshiya TAKASHIMA	Expert on Farming Guidance
3	Soetigno, M.Ed	Counterpart on Maintanance of Machinery (KETUA ROMBONGAN)
4	Ir. Prasetyo Budi Raharjo	Counterpart on Agricultural and Rural Improvement (SEKRETARIS)
5	Drs. Arifuddin Djohansyah	Pembantu Bupati Wilayah Punggaluku
6	Banginduru, BBA	Camat Lainea
7	Drs. Ridwan Mangidi	Camat Tinanggea
8	Irwan Mangidi	Kepala Desa Lalobao
9	Torohula	Kepala Desa Lapulu
10	Asuma	Sekretaris Desa Laeya
11	Juhartin Sappo	PPL Tan.Pangan Desa Lalobao
12	Israh Arofah	PPL Tan.Pangan Desa Lapulu
13	A n a s	PPL Perkebunan Desa Laeya
14	M. Nurali	Kontak Tani Desa Lalobao
15	Nasrun. T	Kontak Tani Desa Lalobao
16	Nurdin. P	Kontak Tani Desa Lapulu
17	Hamaido	Kontak Tani Desa Lapulu
18	Imran D	Kontak Tani Desa Laeya
19	Arif K	Kontak Tani Desa Laeya

図－4


JAWA TENGAH
SURABAYA
BANGKALAN
SAMPANG
PAMEKASAN
SUMENEP
GRESIK
LAMONGAN
BOJONEGORO
TUBAN
MOJOKERTO
SIDOARJO
JOMBANG
NGANJUK
MADIUN
KEDIRI
BLITAR
TULUNGAGUNG
TRENGGALEK
PONOROGO
PACITAN
PASURUAN
PROBOLINGGO
SITUBONDO
BONDOWOSO
LUMAJANG
JEMBER
BANYUWANGI
P.KAMBING
P.KETAPANG
P.SEPANJANG

5．営農技術実態調査

5－1．水稲栽培における作業別労働日数調査

(1) 目的

現在、南スラウエシ州の一部では、水稲の直播栽培が普及しその面積が500haと推定されているが、現実には技術水準が低く従来の陸稲栽培の域をでていない。

しかし水稲作経営からみると、田植え労賃が時期的に高騰するため農家の稲作収益は、田植えより多いと一般に認識されているようである。

これらの状況にあって、当プロジェクトサイト、ラノメト村における稲作全体の作業時間を把握するとともに、苗代・田植作業の位置づけを目的として調査を実施した。

(2) 実施方法

ラノメト村の水稲作付規模別に21農家を選定し、水稲栽培の従事日数を聴取した。調査項目は、苗代作業、本田耕起、苗取り・田植、除草、刈取・脱殻、天日乾燥、その他管理作業の７項目を、1991年乾期作、1992年雨期作について調査した。

(3) 調査結果

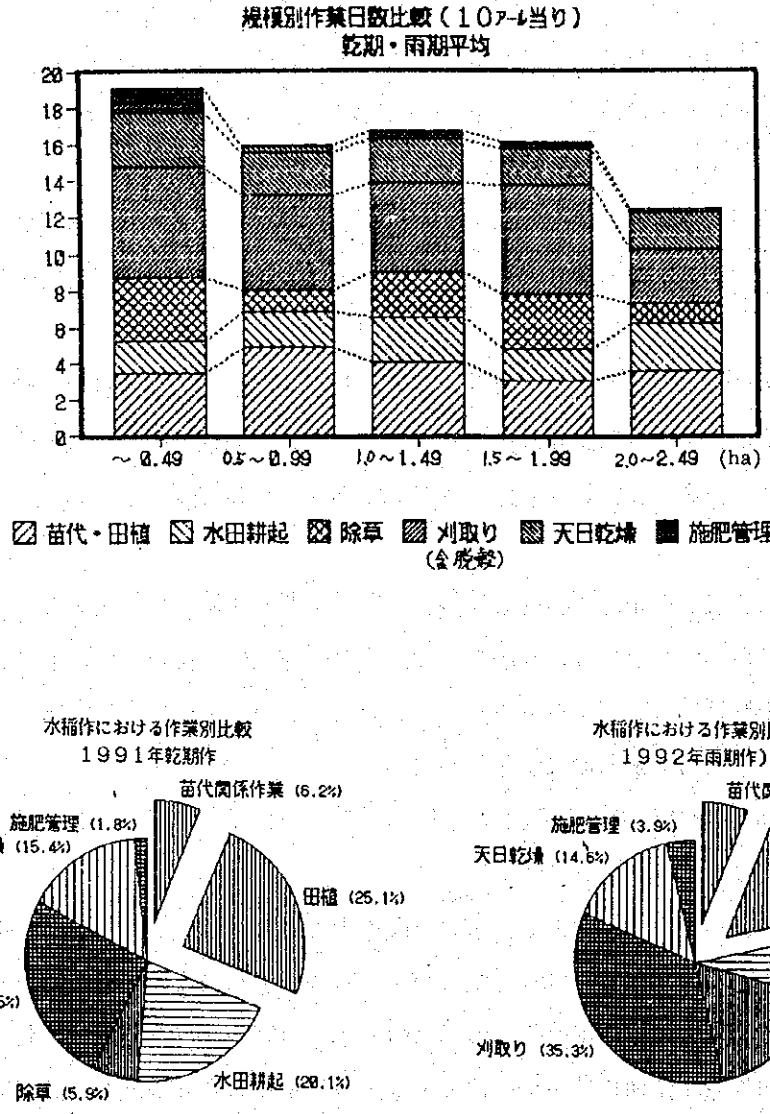
聴取調査は普及員を中心に実施したが、乾期、雨期の明確な記憶を欠くなど、問題点が見受けられ数字的にかなりの幅があった。また、作業の形態は、一般的には田植え、収穫作業は相互扶助（ゴトンロヨン）で行われているが、大規模経営農家、労働力不足農家等は雇用による労働形態に変化しつつある。

図－5・6は、水稲作付け規模別（乾期・雨期こみ)、作業項目別日数を10アール当たりについて比較したものである。

1）除草労働はその変動が大きく、精農と駄農の差のように見受けられる。特に規模が大きくなると、除草剤を使用する農家があり時間の少ないことが考えられる。

2）刈り取り・脱殻は、大規模農家の場合はすべて手製の簡易な回転式脱穀機を所有しており、刈り取った稲を１か所に積み上げ、翌日脱穀・風選等流れ作業で実施しておりこれらが省力的になっているものと思われる。

図は、1991年乾期作、1992年雨期作について、各々の稲作作業を比率で示したものである。これらの実数は雨期作平均18.6日／10アール、乾期作平均13.5日／10アールであり、雨期作の労働日数が38％増加している。特に大きな諭して見られるのは刈り取り・脱穀であり、雨期終期の収穫作業の困難性を示しているのかも知れないが明らかではない。



図－5　規模別作業日数比較（10アール当り）

5－2．野ネズミ被害について

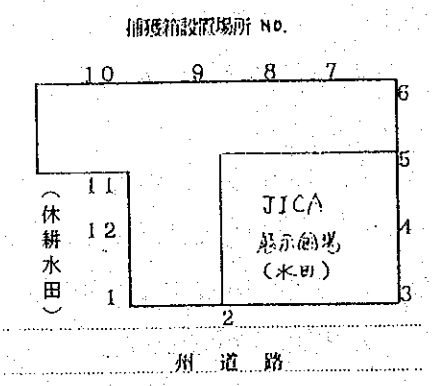
野ネズミによる水稲被害は、インドネシア全般に発生しているようであるが、本プロジェクトサイトにおいても今期は特にその被害が著しい。

実証試験圃も野ネズミ被害に遭遇しているため、前述のように「多頭捕りトラッピング法」によりネズミの捕獲に努力している。これが地域のネズミ生息密度にどの程度影響するか明らかでないが、奈須レポートでは「付近の農家が今年はネズミがいないと言う程に密度が低下した」と報じている。

地域農家も、実証圃のビニールフェンスと、捕獲したネズミの数からその効果を充分認めるところとなった。これらは農民自身の手の届くところの技術であり、努力すればそれなりに解決できる手段のあることを知らしめ、また、グループ等で実践できる方法として今後普及することを期待している。

(1) 「多頭捕りトラッピング法」による野ネズミの捕獲とその習性

「多頭捕りトラッピング法」による野ネズミの捕獲を3月11日より実施した。捕獲箱の位置及び捕獲数は、図－6の通りである。



3月	設置カ所 No. 1	2	3	4	5	6	7	8	9	10	11	12	計
11	4											5	9
12	2		1	0								1	4
13	1		0	0								3	4
14	0		0	0								0	0
15	0		1	0								0	1
16	0		0	0								0	0
17	0	0	1	1	0	1	0	0	2		1	4	10
18	1	0	0	0	0	0	0	1	1	0	1	0	4
19	0	0	0	0	0	0	0	0	0	0	1	0	1
20	1	1	0	0	0	0	0	0	0	1	1	1	5
21	0	0	0	0	0	0	0	0	0	0	2	0	2
22	0	0	0	0	0	0	0	0	0	1	0	0	1
23	0	0	0	0	0	0	0	0	0	2	2	0	4
24	0	0	0	1	0	0	0	0	0	3	1	3	8
25	0	0	0	0	1	0	0	0	0	0	1	0	2
26	0	0	1	0	0	0		0	0	0	0	3	4
27	0	0	0	0	0	0		0	1	0	0	0	1
28	0	0	0	0	0	0		0	1	1	1	0	3
29	0	0	0	0	0	0		1	1	2	0	0	4
30	0	0	0	0	1	0		1	0	1	0	0	3
31	0	0	0	0		1		0	0	0	0	0	1
計	9	1	4	2	2	2	0	3	6	11	11	20	71

図－6　場所別ネズミ捕獲数（3月分）

これらの捕獲場所等から、野ネズミの習性について観察してみた。

1）一度侵入した場所を覚え、いつも同じ通路を通ってくる。

2）餌の多い時期（稲の生育後期、収穫期）に繁殖期入るのか、捕獲したネズミは殆ど雄ネズミであった。また、殺鼠剤を口にくわえたまま途中で死んでいる雄ネズミ、さらには、畦等の巣を掘り返してみると、内部の雌及び子ネズミが雄の持ち込んだと見られる殺鼠剤を喰って死んでいた。（巣内に殺鼠剤が散在していた）

従って、この時期に集中的に雄を捕獲すれば、その後の繁殖力がかなり抑制されるものと思われる。

3）侵入して来る方向性は、サゴヤシ林、荒れ地の草叢が多く、この中に営巣していることが知られ、外部に餌が充分になって繁殖期に入るものと思われた。（捕獲した雄の多くの睾丸が大きくなっている）

(2) 水稲の各種被害に対する組織的対応の欠如

ラノメト村における水稲の各種被害について、組織的防除対策はまったく実施されていない。例えば、ネズミの被害対策等は、個々の農民の防衛もさることながら基本的には、その生息密度を減少しなければならない。そのためには組織力を発揮して、集中的な撲滅作戦が必要となる。水田の中に点在する草叢となった遊休地の解消、林地内の営巣の排除、畦畔の清掃、一斉殺鼠剤の散布等、組織的対応が考えられる。また行政的には、ネズミの尾を持参した者に若干の報償金を支払う等は、よく行われていることである。また昨年のように、地域全体にアワヨトウ虫が発生した時等、行政サイドは全く関知せず、直接割れがプロジェクトに防除を要請してくる現状である。

また現在ラノメト村では、水稲はほぼ周年栽培されている。それらの結果、病原菌、害虫などが周年世代交代して蔓延している。これらの課題に対して、作付け時期になると各組織の代表者の会議を持って、村長、普及員が農民に説明し、田植日を設定して推奨品種を奨励しているが、ほとんど受け入れられていない。その要因は定かでないが、或る農民は「これらは行政的な指導力の問題である。また違反者に対しては、水利組合による水の配水規制等により制裁を実施しないと、地域の稲作は共倒れになると訴えていた。

この問題は、マレーシア国ムダ地区においても、周年栽培で病虫害防除が難しくなっている報告がある。今後、行政当局、普及員と連絡を密にして進めなければならない問題と考えている。

6．その他

6－1．プロジェクト開始後の水稲栽培の動向

(1) 自己開田による経営面積の拡大

プロジェクト開始以来、関係村における水田の自己開田の気運が高まり、その面積は開始前の数倍に及んでいる。例えば最初に着手したラノメト村にあっては、当初30ha程度であったものが、現在では300haとも言われている。これは、プロジェクトで基盤整備を実施すると言うインパクトが過大評価されたものと思われるが、これだけの潜在意欲があることの現れと受けとめられる。しかし、これらの結果乾期の水資源の枯渇は深刻なものとなった。従って地域の農民組織にあっては、雨期は全面積水稲を作付するが、乾期は畑作物を植えざるを得ないことを自覚し始めたようである。このことは従来から説明していたことであるが、1993年乾期作の収穫皆無の経験から学んだ様である。

また、隣村のオネウイラ村（第7番目に実施予定のサイト）では、ラノメト村をしばしば見学して自己開田が進み、当初水田が皆無であったものが現在では50ha位あるとのことであった。この地区は、排水改良を目的としたこともあって、乾期の用水には余裕があるように思われる。

この様に地域開発のインパクトが周辺地域に波及して、営農意欲が触発されたことに関係者一同注目しているところである。

(2) 水稲栽培意欲の増進

地域の水稲栽培面積の増大につれて、その栽培技術の積極的取り組みがみられるようになった。第一は、自動耕うん機の利用である。従来は人力または畜力で耕起していた農家が自動耕うん機で耕起等を行い、作業能率の向上及び深耕を図っている。第2は新技術の導入に意欲がでてきたことである。例えば一部の農家では、肥料を施用して高収量をあげラノメト村の平均収量は増大しているようである。しかし一般農家においてはその効果について十分認識しているようであるが、周辺に肥料の販売店がなく簡単には入手できない現状にある。肥料購入制度としては、農民組合単位に栽培改善計画を一定様式に記入し、それを普及員の承認を得て協同組合に提出すれば、資金の前借りで肥料が購入できるシステムとなっているがまだ一般化していない。

また、新技術の取り組みについても非常に積極的であり、直播栽培、ネズミ防護フェンスの設置、虫害の集団防除などにも取り組みつつある。

なお、パランガ・キヤエア村にあっても、移住農民間では労働力の逼迫等から直播栽培に取り組み好成績を挙げ、今後は組合員全員に普及させたいと言っていた。

6－2．ラノメト村の水田作付体系試案

(1) 現況

ラノメト村周辺における現況水田の作付は、雨期は100％、乾期では70％位は水稲を作付けしている。しかし、この地域の乾期の降雨量は少なく、特に平均5年に1度位に渇水年となっている。また、近年地域の開田が著しく、この時期の用水不足が一層深刻な状況となっている。そのような中でも乾期に水稲を植える社会的な条件として、都市に近いため兼業農家が多く、水稲を植えて管理も程々で栽培すれば収穫できることによるものと思われる。

(2) 水稲栽培

かんがい施設が整備された一部の地域では、水稲二期作は可能であるがそれは作付け以前に地域内で十分話し合って、乾期作の水管理を円滑にする必要がある。そのためには、当該年にかんがいする水系内の場所、面積を確定するとともに、作付け時期を明確にして農家に徹底することが必要である。

雨期作は1月の早い時期に一斉に作付けすることが望ましい。

また、雨期の降雨が遅いことも想定して、試験研究機関では乾田直播を奨励している。これは一般にゴゴランチャと呼ばれ、乾田状態で播種し自然に発芽させ雨期の雨に繁げるものである。この問題点は雑草の繁茂であり、これを除草剤で如何にうまく制御するかが普及のキーポイントである。

乾期作は、雨期作の収穫後すぐに耕起して作付けし、降雨を有効利用することである。

この現実のもとに、地域の作付体系を策定することに矛盾を感じるが、可能性として試案を試みた。

地域の雨期の始まりは12月で、3・4月が最も多く7月から乾期に入る。従って1月から雨期作が可能であるが、州政府の推奨は2月となっている。その理由として降雨が安定することと、これより早いとネズミの被害が大きいとのことであるが、その実態は定かでない。これらを勘案して、雨期作の水稲栽培は2月より開始することとし、乾期の用水確保が可能な地域では早稲種を年2作、不可能な地域では年1作として晩生種を栽培することが望ましい。

用水不足の大部分の水田では、6月末または7月始めより大豆、緑豆、トウモロコシ、野菜等を栽培する。この時期は雨期の終息時で降雨も十分あり、発芽、初期生育には好都合である。8・9・10月の降雨は、その変動が大きく一般には干ばつ年が多く、収量が減少することも考えられる。

10月は最も雨量の少ない月であるが年変動が大きく、3期作の可能性が十分ある。この3期作として、セスバニアを栽培して地力の増強を奨励したい。また、都市近郊野菜

等の栽培も短期作として導入することが望ましいものと考えられる。

このような観点から、次図の４ケースの体系を作成してみた。特にこの地域の作物を考える時、猪の被害を回避できる作物とネズミ被害である。猪被害は、栽培面積を集団化・拡大すれば単位面積当たり被害が少なくなるように思われる。ネズミ被害はその繁殖力が大きいため、単位当たり被害の減少には影響しないように思われるが、極力防除に務め、その棲息密度を低下させることが必要である。

６－３．種子貯蔵庫について

(1) 設置目的

（要請の背景）

現在、インドネシアでは米の自給を達成し、水稲から畑作物への作付け転換を農民に指導している。特に輸入の多い大豆については、州政府（当時の州知事）がプロジェクトを組織して作付けを奨励してきた。従ってこれに必要な種子の供給のために、種子貯蔵庫の建設を要請してきた。

長期調査時にこの要請を受けて、農業省地域事務所長と協議した結果、郡に一か所ある農業普及所の敷地内に建設することとなった。

（必要性）

農家が自家採種した穀物種子を、温度変化の少ない涼しい場所に貯蔵するための施設である。一般に採種した種子は、その貯蔵を誤ると次期の発芽率に大きく関係するため、農家は貯蔵に神経を注いでいる。これは収穫後、子実内水分が高くかつ高温で経過すると、子実の酵素活性が持続して次期の発芽能力が低下するとされている。従って種子をよく乾燥し、低温状態で貯蔵し酵素活性を抑制する必要がある。しかし、熱帯の高温多湿状況ではその管理が難しく、特に大豆、トウモロコシは自然状態ではその発芽能力が著しく阻害されて、次期の作柄に大きく影響する。

(2) 貯蔵庫の構造と庫内環境条件

貯蔵庫は、中間に断熱剤（ビニール発泡スチロール）を入れたコンクリート製の構造物とし、密閉扉で外部と遮断するようにした。また、外部は直射日光を避けるためと、庫の外部の空気循環のため、ベンチレーション効果を期待して建物で覆った。

庫内の温度は、昼夜変化なく25度で現在も推移している。また、相対湿度は、建設当初は90％近くあったが、現在では70％程度となっている。

(3) 貯蔵方法

農業研究強化プロジェクト専門家の研究によると、大豆の収穫子実を、天日乾燥10時間で子実の含水率は６％まで低下する。これをビニール袋に入れて密封することによ

り、この水分を維持することが可能である。これを温度20度から25度以下で貯蔵すれば、種子の発芽力を1か年以上維持することが確認されている。

当プロジェクトでも試行的にこの方法で、完成した貯蔵庫に大豆を1か年貯蔵した後発芽試験を実施した。結果は、格納時の発芽率は78％（水分含量10％）であったが、1年後の発芽歩合は76％（水分含量11％）とほぼ同様であり、庫の機能が明らかになった。

(4) 貯蔵庫の利用方法

プロジェクト開始当初は大豆の作付け推進機運があったが、州知事の交代、また、その収益性が低いこともあって、その機運が衰退してきた。一方、当初計画のラノメト村内農家の種子貯蔵を前提にしたとき、搬入手段の便が悪いことも問題点となり、殆ど利用されていなかった。

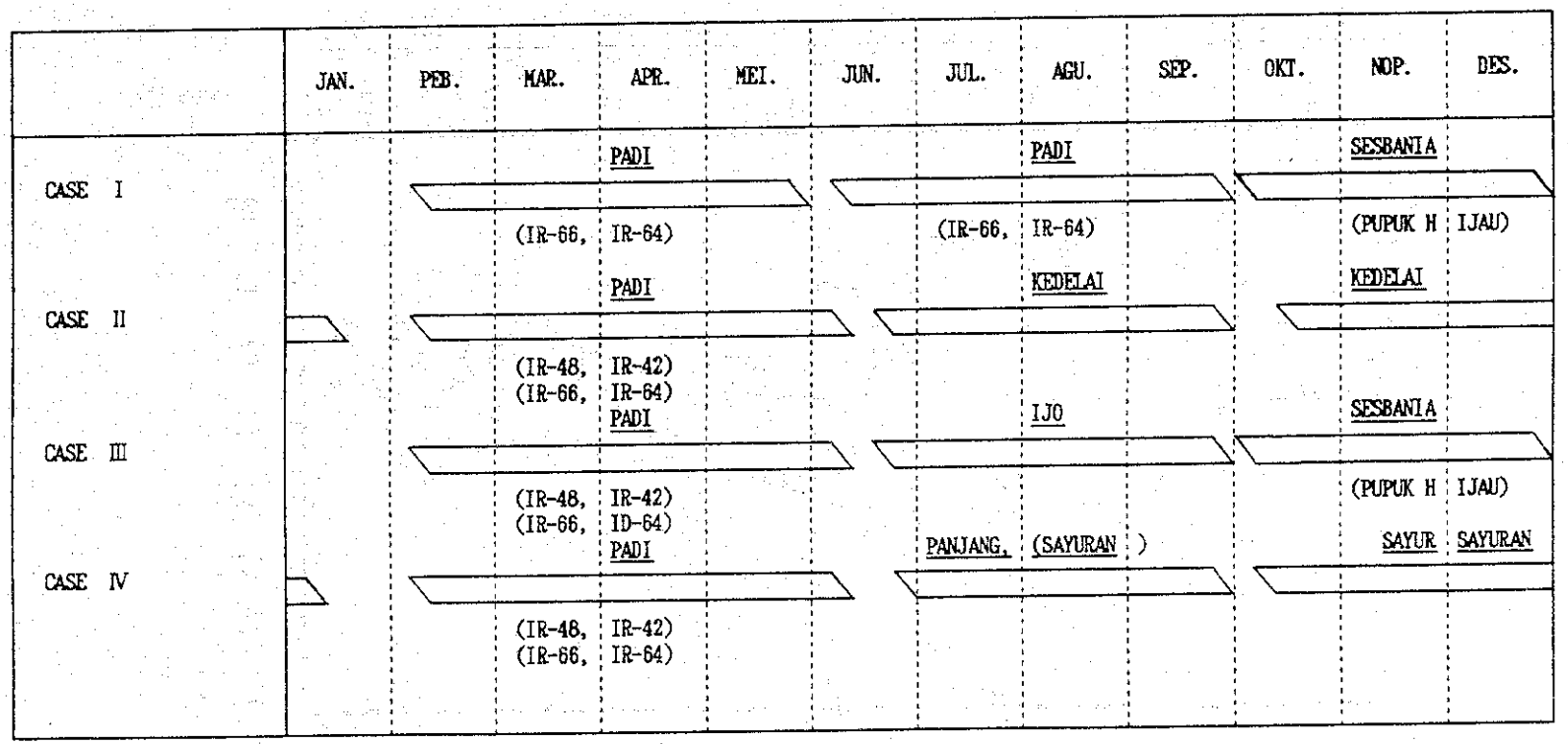
その後、当施設の利用方法について関係者と検討を続けた結果、現在トウモロコシの作付け奨励が行われ、そのための種子の需要が高まっている。その需要を達成するため、当プロジェクト畑作展示圃で生産した種子、種子生産農家より集荷した種子を次期播種期まで（約6か月）貯蔵する方法が検討されており、その貯蔵を当施設で実施することの要請が関係機関（州種子検定所）よりあり現在貯蔵を開始した。又、農家個々の種子も希望者があれば貯蔵するとともに、今後ラノメト村内だけでなく周辺農家も対象としてその活用範囲を拡大し、貯蔵効果の普及に努めるべく関係機関とその対応について検討しているところである。

(5) 今後の建設計画について

今後のプロジェクトサイト村でもその施設の要請が大きい。しかし、ラノメトでの反省を踏まえて、農家の利用し易い場所。小規模の施設で、将来農家レベルで建設可能なものでなおかつ、断熱効果のある施設の検討をしている。

1994.2.25

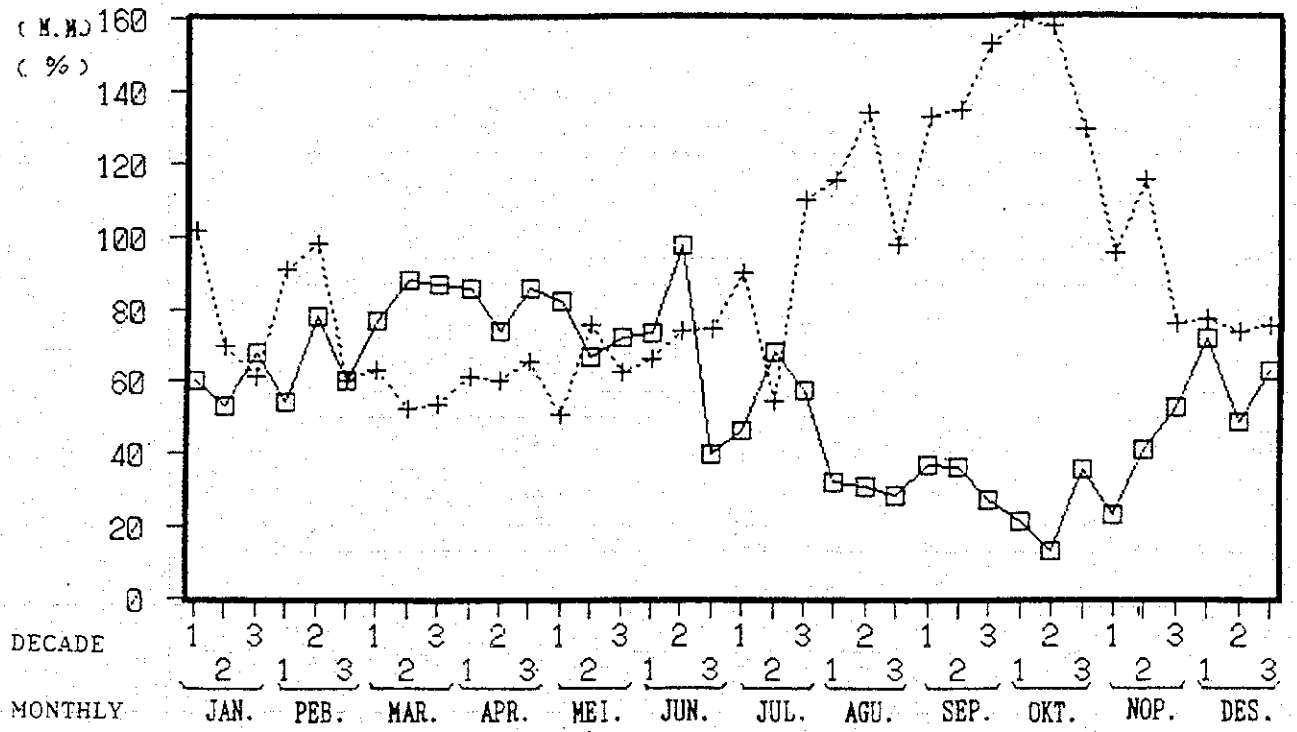
図－7　　CROPING SYSTEM IN RANOMEETO FOR PADDY FIELD



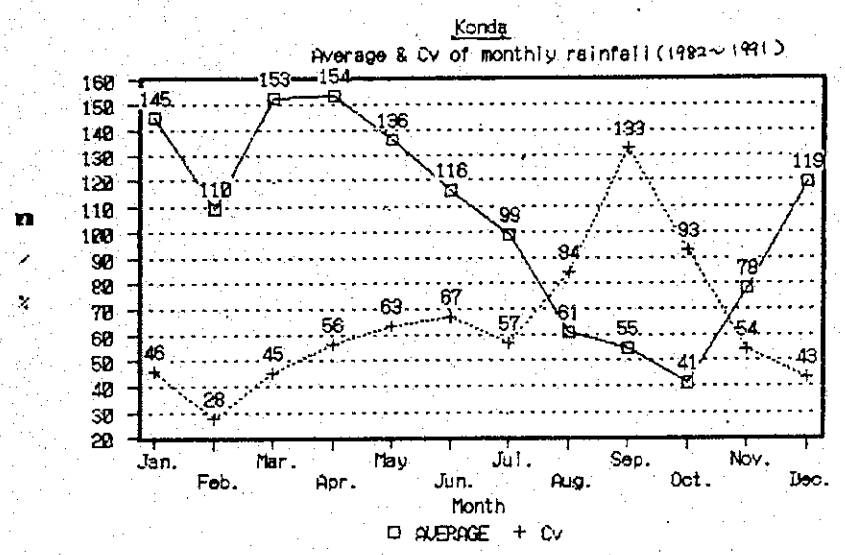
図－8

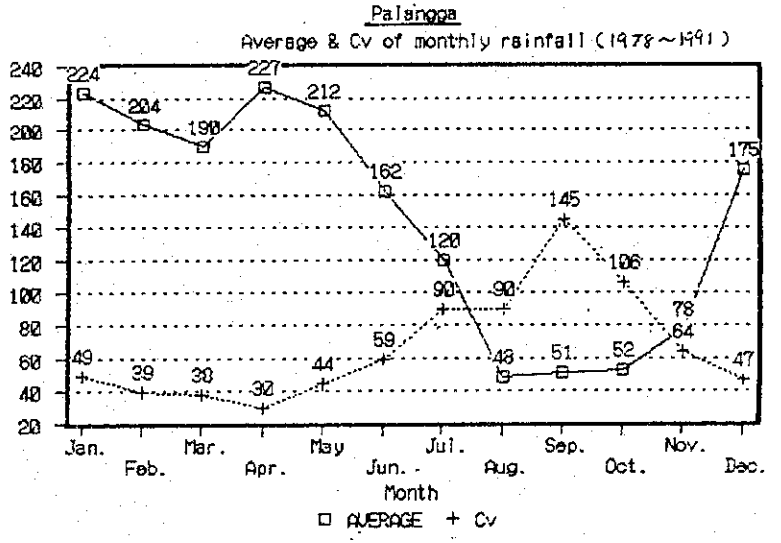
AVERAGE & CV. OF DECADE RAINFALL (1972～1991)

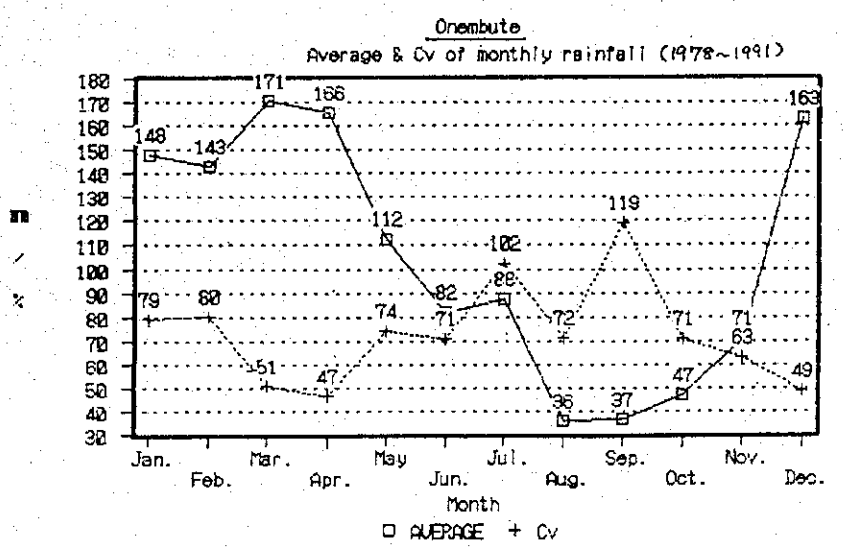
RANOMEETO(AIRPORT)

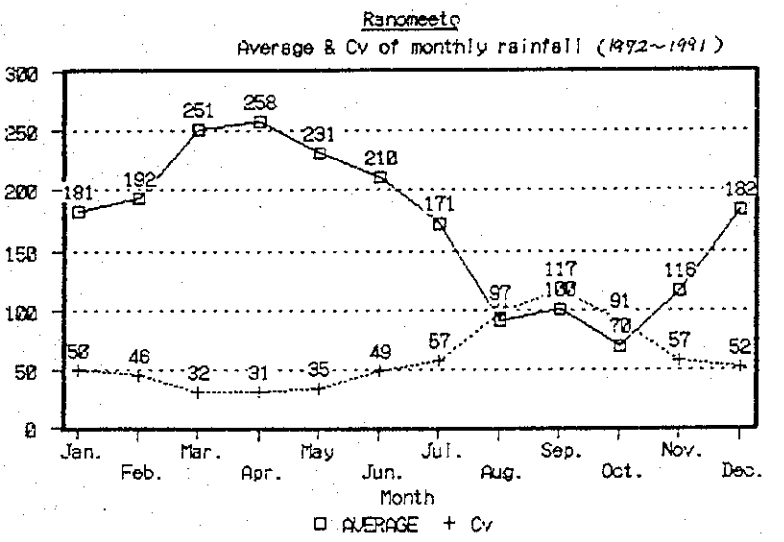


図－9


Konda
Average & Cv of monthly rainfall (1982~1991)
mm / %
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.
Month
□ AVERAGE + Cv


Palangga
Average & Cv of monthly rainfall (1978~1991)
mm / %
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.
Month
□ AVERAGE + Cv


Onembute
Average & Cv of monthly rainfall (1978~1991)
mm / %
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.
Month
□ AVERAGE + Cv


Ranomeeto
Average & Cv of monthly rainfall (1982~1991)
mm / %
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.
Month
□ AVERAGE + Cv

おわりに

(1) 当プロジェクトの基礎調査、長期調査に参画し、その後プロジェクトの一員として事業に参加できたことを大変光栄に思っている。このプロジェクトは農民参加型草の根事業といわれていたが、事業の内容は昭和50年頃日本国内で盛んに言われた「農村総合整備パイロット事業」をイメージしていた。当時私もこの事業計画を担当し、農村開発の夢を託した思い出がある。今回のプロジェクトは具体的には、当時の町村を対象とした「農村総合整備モデル事業」に営農指導等のソフト事業が導入されたものと理解し、その時の計画手法を応用すべく努力した。

(2) 営農指導分野の活動方針として、水稲、畑作物、エステート作物について、地域に適合した栽培技術の演示をカウンターパートとともに実施した。この栽培技術をカウンターパートへの指導とともに、村の普及員と地域の篤農家で実証しながら普及の拠点とした。従って、一般の農家への指導は普及員が直接当たることとした。ただし、実際には専門家が地区を巡回しながらアドバイスする部分が多かった。

(3) 地域に適合した作物の選定を意図して種々試作したが、ネズミの被害、猪被害が著しく、水稲はともかく畑作物については、その種類は限定された。従って、地域の作付体系の策定についても現実性がなく試案にとどめた。

(4) 現地での中堅技術者養成対策事業に際し、プロジェクト後方支援で作成されたビデオ、スライド、及びテキストが現地の研修者に非常に好評であった。また、支援からネズミ、猪被害等について種々アドバイスを戴き厚くお礼申しあげます。

7．展示圃における展示内容写真集

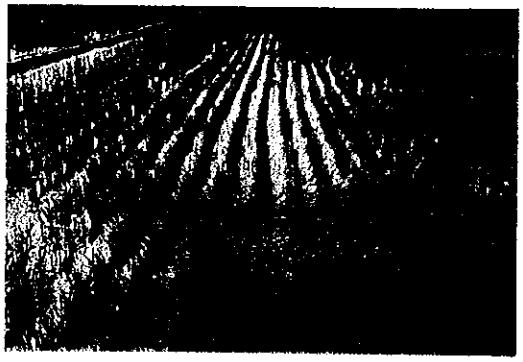
水稲直播栽培
条播栽培方式(ラノメト展示圃場)

2条式播種機による播種作業
(播種密度40kg/Ha)

播種後1週間目の発芽状況

播種後2週間かんがい開始

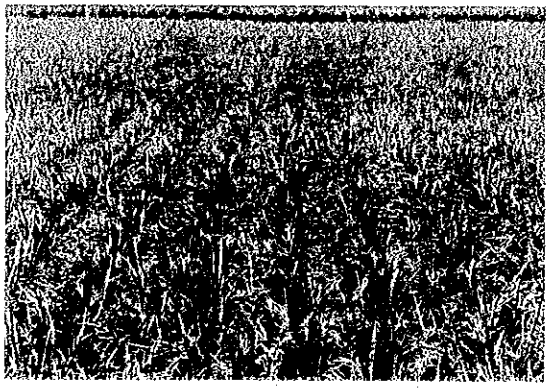
基肥施用



播種後20日の生育状況

人力回転除草機による除草作業

乳熟期の生育状況



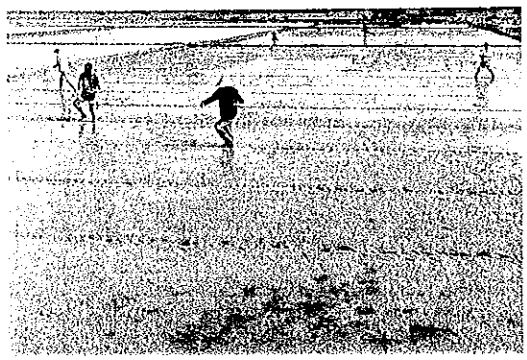
収穫期前の状況

刈り取り期の状況

坪刈作業（3㎡）

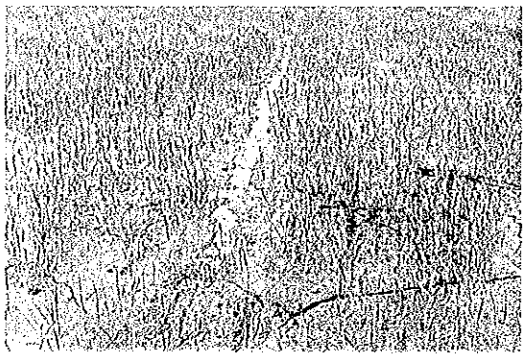
散播栽培方式

3ｍ短冊の蒔床作成作業

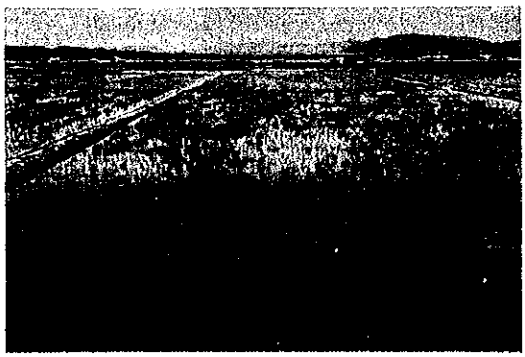


播種作業（播種密度50kg/Ha）

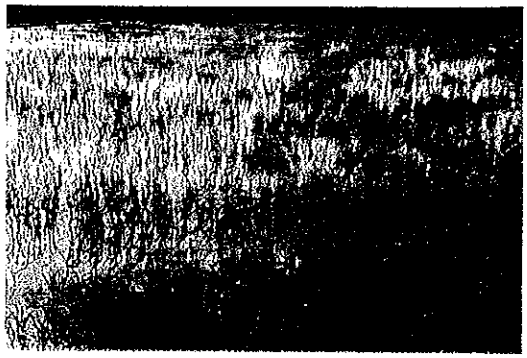
播種密度

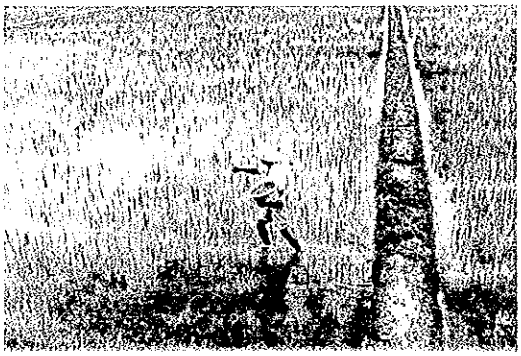


播種後２週間目の生育状況

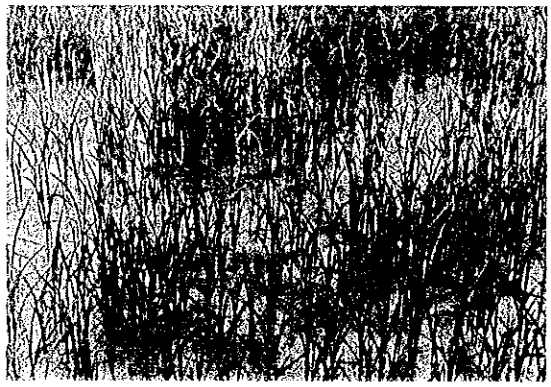


播種後２週間目のかんがい開始



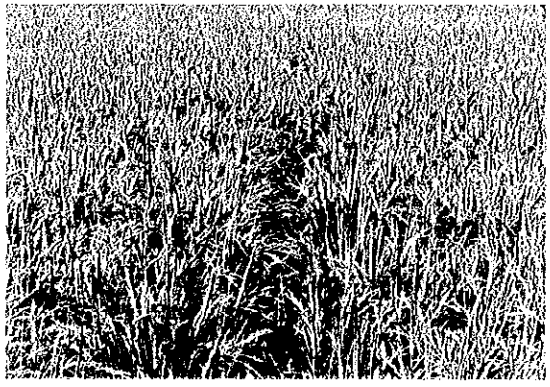


基肥施用

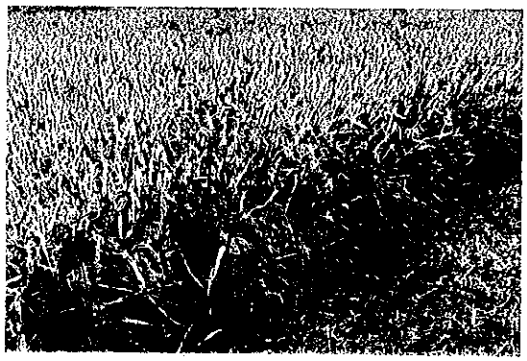


基肥後の生育

薬剤の散布



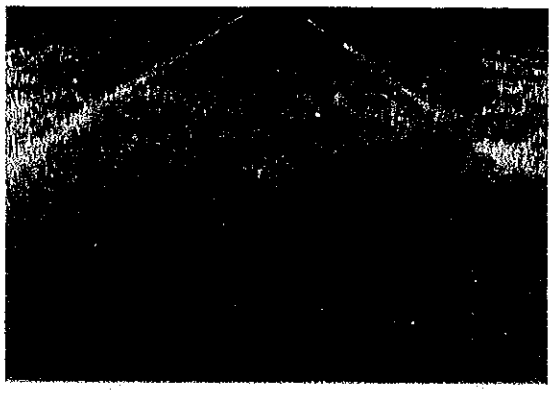
乳熟期の生育状況



収穫期の生育状況

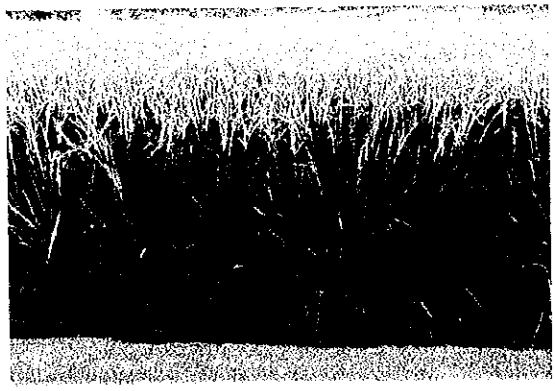
坪刈調査（3㎡）

キアエア村水稲展示圃



発芽後灌水した状況

幼穂形成期の生育状況



湖熟期の生育状況

畑作栽培

石灰散布（開畑当時はph4.0前後であり、改良目標ph6.5改良深15cmとして石灰量7.0Ton/haを施用した）

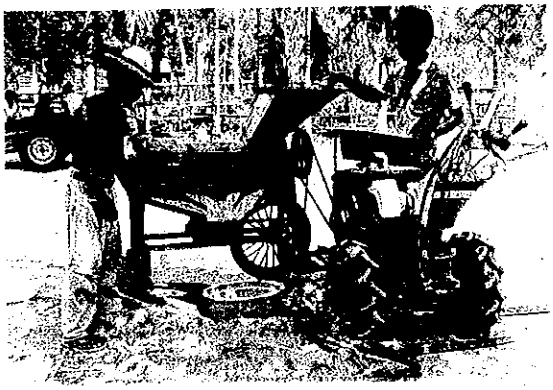
大豆の培土栽培(培土前の薬剤散布)

培土直後の大豆

成熟期の大豆

トウモロコシのホースかんがい

出穂前のトウモロコシ



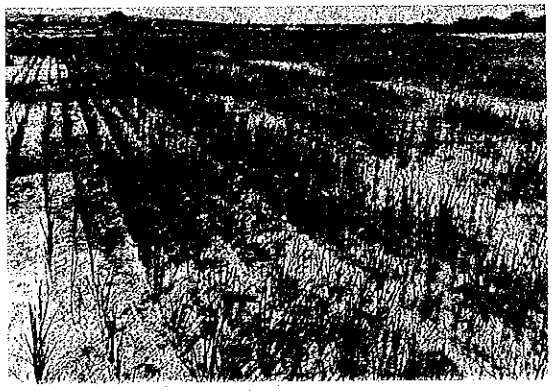
トウモロコシの脱粒作業

新墾畑に栽培したセスバニアの鋤込み

エステート作物

エステート作物展示圃場（キャッシュナッツ）

間作作物として陸稲在来種の播種



陸稲の生育状況

施肥後の生育状況

出穂期の陸稲

8．添付資料

ACCOMPLISHMENT REPORT OF FARMING GUIDANCE

June 1994

By :

MR. YOSHIYA TAKASHIMA

The Integrated Agricultural and Rural Development Project
in Southeast Sulawesi Province
IARDP, ATA-481

FOREWORD

The Project (ATA-481) is situated as the Model Project of Integrated Agricultural and Rural Development Program in line with the Development of Eastern part of Indonesia.
The Project is being carried out for the purpose of introducing knowledge and technology for appropriate agricultural and rural development in underdeveloped regions, it is based on the natural and social conditions in rural area.

I had joined to the Project for three (3) years since June 5, 1991 that was three (3) months delayed from the commence of the Project dated on March 1, 1991, in Record of Discussion.
My responsible was to transfer technic on farming guidance in particularly with the experiment and demonstration by advanced farming techniques, establishment and training of farming system by using adequate machinery.

As a result of my observation on present farming condition and discussion with farmers about the problems on improvement of farming since my assignment, it was found that the main problem was how to solve the lack of manpower on farming, especially during the transplanting of rice seedling as known as busiest farming season.

Therefore, my subject was how to improve the rice planting method, in particularly to transfer technology of the direct sowing method through experimental planting.
In consequence of the study, this method was accepted for practical planting with pleasant of diligent farmers, however it is considered that some improvement are necessary to establish farming system accepted by the farmers.

In the subject of secondary crops cultivation, the experiment and demonstration on some advanced cultivation methods of mainly soybean and corn cultivation which was known as recommendable crops by National Government, was carried out.
However, some of these works were not obtained good results caused by attacks on the crops by wild pigs.

In the subject of estate crops cultivation, this field was the first experience to study for myself.
In consequence of demonstration study through discussion with the farmers about the suitable crops for intercropping of estate crops cultivation, the upland rice was accepted by the farmers with the reasons of obtaining additional farm income and was not attacked by wild pigs.

However, the countermeasures to avoid wild pigs attack was not established yet.
In case of countermeasures for rats attack, the fencing plastic method around the field was effected and accepted on practical farming.

Finally, thanks are due to the persons concerned in Indonesia for their assistance in my work and daily life, especially Mr.Ir.Rijal, Mr.Ir.Ma'ruf as counterparts and Mr.Ir.Nodi Sattu as a staff of Food Crops Office.

May 1994

Yoshiya TAKASHIMA
Expert on Farming Guidance

I. The Summary of Activities

1. Rice cultivation

1-1. Problems on rice cultivation in the region

1-1-1. Deep planting of aging seedling

In the project site, most of farmers are planting aging seedling in 5cm depth. Thus the yield are limited by the reason with the decrease of number of tiller and ear per hill are few.

The reason of aging seedling is delayed of transplanting caused by lack of irrigation requirement in the paddy field and dense sowing in the seed bed, and deep planting is caused by lack of puddling and remarkable undulation in the paddy field.

It is considered that the meaning of importance of levelling and irrigating a water equally in the paddy field is not understood by the farmers.

1-1-2.Non-fertilized cultivation

Non-fertilized cultivation is taking by most of farmers. It is considered that this way is to avoid the risk of uncertain harvest caused by unskilled farming technic and lack of irrigation requirement.

Generally, the farmer disposed this matter caused by lack of money. It seems to me that they are missing the purpose of farming.

1-1-3. Lack in consciousness for water management

Though the farmers know that water is an important factor for rice cultivation, only continuous irrigation is in their consciousness.

Therefore it was not understandable that propagation of grass and growth of non-productive tiller may be controlled under submerging, reduction of soil may be incidentally prevented under drainage of water.

1-1-4. Lack in consciousness for regional or collective pest control

The farmers lack in consciousness for collective pest control and individual spraying of chemicals have no effect on pest control.

Also regarding the damage by rats, they have no mind that rats propagated at the follow paddy field in the region may spread and harm.

1-2. Result of the experiment

1-2-1. Direct sowing and variety test

The purpose of the experiment are to confirm the effect of direct sowing and variety test.

The result of yield survey on split-plot experiment with three repetition by drill seeding, broadcast seeding and four varieties are shown in Table 1. It means that the yield is around two times as compared with 2 - 3 ton/ha on the average in the region (the amount of fertilizer applied recommended by Government is adopted).

Also drill sowing method is obtained higher yield compared with broadcast seeding method.(The detailed are referred to the text.)

Tabel 1. Yield of Direct Sowing

(ton/ha)

treatment	variety	block			mean value
		I	II	III	
broadcasting	IR-64	3.56	3.80	4.09	3.81
	IR-42	5.00	5.42	6.56	5.66
	IR-48	6.82	7.79	6.44	7.02
	Ciliwung	5.03	4.28	4.56	4.62
drilling	IR-64	4.54	3.56	4.93	4.34
	IR-42	5.81	7.71	6.47	6.66
	IR-48	8.05	7.76	7.17	7.66
	Ciliwung	5.24	4.82	5.34	5.13

1-2-3. Setting of the subjects of demonstration in connection with the yield

- Germinated seed direct sowing rice cultivation -

The technology development for cultivation for saving manpower was undeveloped, as the source of labor on rice cultivation in Indonesia are maintained by abundant manpower and gotong-royong system. Especially, in Eastern part of Indonesia, it is difficult to keep the manpower and the main manpower during transplanting of seedling count on women and children.

Therefore, the inferior technic such as deep and sparse planting are appeared.

On the other hands, it is recommended to carry out the direct sowing cultivation to release the manpower for women and children and expectation of the increasing yield.

Therefore, this is to demonstrate and extend the direct sowing cultivation technics.

We have four times of harvest on the direct sowing cultivation since 1992 at Ranomeeto Demonstration Farm. The result of yield are shown as Table 2.
The yield is decreased in the rainy cropping season, however, the yield in the other years indicated 5 ton/ha. Fig. 1 shows the comparative of the yield between broadcasting and drilling cultivation method by each variety.
It was found that the yield on drilling cultivation method gained the increasing yield of 8 to 18 % compared with broadcasting cultivation method by any variety. Also, if compared between growing period and yield, it was found that the variety of long growing period indicated the high yield.

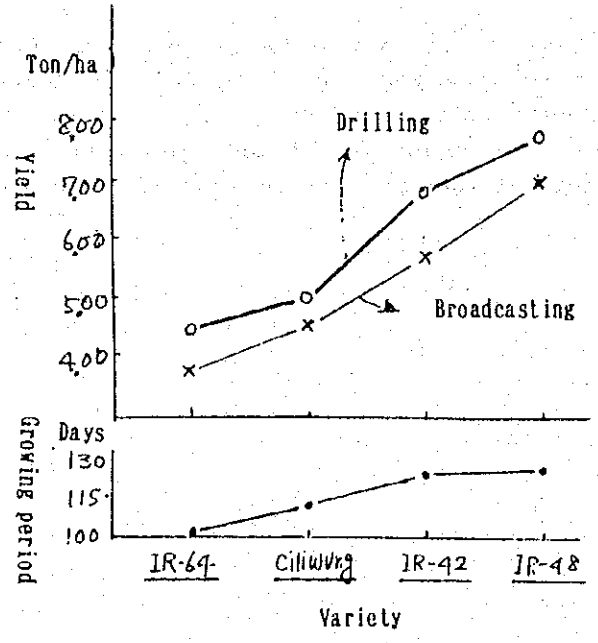
Table 2. MEAN VALUE YIELD

(kg/ha)

direct sowing method	variety	1992 (Feb -Jun)	1992 (Aug -Dec)	1993 (Jan -May)	1993 (Aug -Nov)
broadcasting (JICA Field)	IR-42	5,663		*	
	IR-48	7,019		3,226	
	IR-64	3,817			5,640
	IR-66		5,129		
	ciliwung	4,624			
driling (JICA Field)	IR-42	6,659			
	IR-48	7,664			
	IR-64	4,345		4,954	5,772
	IR-66				
	ciliwung	5,134			
broadcasting (Farmers Field)	IR-42	3,865		*	
	IR-48			3,153	
	IR-64	5,614	4,931		
	IR-66		5,412		
	ciliwung	4,917			
transplanting (JICA Field)					
(30cmx10cm)	IR-48			4,374	
(25cmx10cm)	IR-48			3,263	
(20cmx20cm)	IR-64		4,931	2,698	

* damaged by rat

Fig. 1. Relationship between yield per Ha and variety



1-2-4. Economical merit in direct sowing cultivation

The saving manpower during transplanting of seedling is the greatest merit.

The survey of working hours labor on transplanting cultivation in the dry season was conducted and how the direct sowing cultivation may economize on labor cost was calculated.(see Tabel 3.)

The condition on the premises are followed.

a. The comparison study was conducted among the transplanting cultivation, broadcast seeding cultivation and drill seeding cultivation.

b. The cultivation by each cropping system was conducted at the dry season and the yield was expected 5 ton/ha.

c. The changed factors was six item such as seed pretreatment, preparation of seed bed, levelling of field, transplanting, weeding work and water management and other factors was not changed.

d. The manpower by family, gotong-royong and hiring etc. was evaluated to same manpower per hectar and the labor cost was calculated as Rp.4,000 per day.

e. The fertilizer, one of production materials was applied same amount in each cultivation type.

The result are followed.

a. It took a cost Rp.1,059,000 of total production cost for ordinal transplanting cultivation and Rp.154,000 (14.5%) of the cost of production materials out of total production cost.

b. The preparation of seed bed and transplanting were excluded in the broadcasting seeding cultivation. The working hours for weeding was reduced by using herbicide.

It took a cost Rp.811,000 of the production cost and 23% of production cost was reduced compared with the production cost at transplanting cultivation, but Rp.60,000 was increased as the cost of production materials.

c. The working hours of drill seeding cultivation took a time compared with broadcasting seeding cultivation, but the working hours for weeding was reduced because of using manual rotary weeder.

It took a cost Rp.767,000 of total production cost of drill seeding cultivation and 28% of production cost was reduced compared with the transplanting cultivation.

Table 3. Production cost by transplanting

kind of working	working way	cost of labour			production requisites cost	production cost
		required time (hr/ha)	unit price (Rp./hr)	cost of labour (Rp./ha)	(Rp./ha)	(Rp./ha)
seed preparation	human power	-	-	-	15,000	15,000
nursery bed everything	human power	64	500	32,000		32,000
plowing & preparation of soil	animal power	28	5,000	140,000		140,000
basal dressing	human power	8	500	4,000	69,500	73,500
transplanting	human power	320	500	160,000		160,000
top dressing	human power	8	500	4,000	69,500	73,500
weeding	human power	480	500	240,000		240,000
water management	human power	80	500	40,000		40,000
control	human power	20	500	10,000		10,000
cutting & threshing	human power	400	500	200,000		200,000
drying	human power	150	500	75,000		75,000
total				905,000	154,000	1,059,000

Note; 1 day = 8 hour
1 day = Rp. 4,000. (include lunch,snack)
Yield = 5,000 kg/Ha
(paddy price. 5,000kg/ha x Rp.400/kg = Rp.2,000,000/ha

PRODUCTION COST BY BROADCAST SOWING

kind of working	working way	cost of labour			production requisites cost	production cost
		required time (hr/ha)	unit price (Rp./hr)	cost of labour (Rp./ha)	(Rp./ha)	(Rp./ha)
seed preparation	human power	4	500	2,000	25,000	27,000
nursery bed	human power	-	-	-	-	
plowing & preparation of soil	animal power	28	5,000	140,000		140,000
basal dressing	human power	8	500	4,000	69,500	73,500
puddling	human power	16	500	8,000		8,000
broadcast sowing	human power	8	500	4,000		4,000
top dressing	human power	8	500	4,000	69,500	73,500
weeding	human power	200	500	100,000	40,000	140,000
water management	human power	100	500	50,000		50,000
control	human power	20	500	10,000	10,000	20,000
cutting & threshing	human power	400	500	200,000		200,000
drying	human power	150	500	75,000		75,000
total				597,000	214,000	811,000

PRODUCTION COST BY DRILL SOWING

kind of working	working way	cost of labour			production requisites cost	production cost
		required time (hr/ha)	unit price (Rp./hr)	cost of labour (Rp./ha)	(Rp./ha)	(Rp./ha)
seed preparation	human power	4	500	2,000	25,000	27,000
nursery bed	human power	-	-	-	-	-
plowing & preparation of soil	animal power	28	5,000	140,000		140,000
puddling	human power	16	500	8,000		8,000
basal dressing	human power	8	500	4,000	69,500	73,500
drill sowing	human power	40	500	20,000		20,000
top dressing	human power	8	500	4,000	69,500	73,500
weeding	rotary weeder	80	500	40,000	40,000	80,000
water management	human power	100	500	50,000		50,000
control	human power	20	500	10,000	10,000	20,000
cutting & threshing	human power	400	500	200,000		200,000
drying	human power	150	500	75,000		75,000
total				553,000	214,000	767,000

PRODUCTION REQUISITES COST

production requisites			unit price	requisites cost
seed	transplanting	30 kg/ha	Rp. 500/kg	Rp.15,000
	direct sowing	50 kg/ha	Rp. 500/kg	Rp.25,000.
herbicide	Ronster (DMR-6)	4,000 cc/ha	Rp. 10/cc	Rp.40,000
fertilizer	Urea	200 kg/ha	Rp. 280/kg	Rp.56,000
	TSP	200 kg/ha	Rp. 310/kg	Rp.62,000
	KCL	60 kg/ha	Rp. 350/kg	Rp.21,000

1-2-5. Items for guidance and subjects

- Instructions on direct sowing cultivation

a. Thoroughly levelling within 1-2 cm height difference.

b. Making a drainage ditch in the circumference of seed bed to avoid flooding at rainy season.

c. Five (5) days before sowing, flood the rice field in 3 cm height and apply herbicide (Ronster) (Apply DMR at sprouting stage in case of not using Ronster)

d. Four (4) to five (5) days after drained off the water in the seed bad, sow the seed.(A method to know soil hardness was done by dropping a stone sized of golf ball from the height of man shoulder to soil surface before sowing. If half size of ball sank below the surface, it means the soil hardness is good for sowing).

e. Seeding density is 50kg/ha.

f. Sow the seed in the seed bed divided into 3 m length. In case of drill seeding, sow the seed in row 30cm apart.

g. Alert to the injury by rats and birds after sowing.

h. Start to irrigate the field at 5 to 7 days after germination.

i. Apply fertilizer at 15 days after sowing.

j. Alert to the injury by insect pest at the young seedling stage.

1-2-6. Results and evaluation

1-2-6-1. Rat control

The damage by rat was remarkable at the Project Site too and it was found frequently that none yield at all caused by rat.

When the damage by rats was occurred at the Demonstration farm, it took measures and it was effective with reduction of damage that fencing the plastic film (20 to 30cm width) at the border of the field for prevention rat to trespass into the field.

Also the Multi-trapping method designed by JICA Crops Protection Technical Cooperation Project was tried at 2.5ha rice field including the Demonstration Farm.(Fencing the plastic sheet in 30cm height and trapping boxes were placed.)
As result, one hundred (100) rats was captured within 20 days after setting the trap.

From observation at the captured place, the habit of rat are followed.

a. The rat remember the trespassed place and pass through the same way.

b. It was known that the habitat of rat are in Sago grove, fallow paddy field and grassland. They are making nest there, and the breeding season begin under the condition of enough food outside

Reference : PEDOMAN PENGENALAN DAN PENGENDALIAN HAMA TIKUS

1-2-6-2. Group control of Rice army worm

The swarming and eating rice army worm in the rice field was found after a flood. This worm disperse and injure the rice all over the district was found on the observation in the neighborhood.

Afterwards, farmers of one farmer's group who were farming at the 12 ha objective rice field was urged to conduct the group pest control after preparation of materials.

The rice army worm is hiding in the hill or grass at day time and active at night time, therefore spraying of chemicals was conducted from evening to midnight by farmers under the instruction of extension workers.

As the result, subsequently damage by the worm was not found and the necessity of group control was recognized by farmers.

In the general, it is known that rice army worm family suddenly generate, however the mechanism of generation is not clear, and this worm is apt to generate after a flood. The young larvae eat leave with splashed patterns, and mature larvae eat neck of spike with living gregariously, serious damage is caused and prove none yield.

1-2-6-3. Direct sowing cultivation

The evaluation by farmers are followed.

a. The yield quantity in direct sowing cultivation is higher compared with transplanting cultivation.

b. It was doubtful that lack of labor for pulling seedling and transplanting, and a sudden rise in labor cost. However, direct sowing cultivation is more economical because of unnecessity of labor cost.

c. The sowing work is a simpler work.

d. The pace on sowing work can be adjusted against the transplanting seedling that should be transplanted in the whole area all at once.

The area of direct sowing cultivation in the rainy season cropping of this year are 13 ha in Ranomeeto Village and 7 ha in Palangga and Kiaea Village.

2. Secondary crops cultivation

2-1. The problems on secondary crops cultivation in the region

2-1-1. The selection of crops are restricted because of damage by wild boars.

Many wild boars is living in Southeast Sulawesi Province and the damage of crops by wild boars is remarkable.

Therefore, crops for home consumption is fencing with ordinary material. However in case of large scale farming for the purpose of sale, farmers are not able to fence by themselves.

Consequently, farmers select the crops that will not be damaged seriously by wild boars and range of selection of crops are restricted.

2-1-2. Mixed cropping

The secondary crops is cultivating mixed with other crops.

It seems that this method is rational for the reason that the damage of crops can disperse and available land utilization, however field management become to be difficult in large area.

2-1-3. The policy of promoting secondary crops cultivation and post-harvest

Cultivation of soybean and corn are recommended, however the adjustment of harvesting, drying process, and marketing are behind.

2-2. Result of experiment

2-2-1. The experiment of fertilizer requirement on the soy bean cultivation

The experiment for fertilizer requirement and the effective of rice straw mulching was carried out and result in the experiment indicated significant variation between the amount of fertilizer applied and the yield.

The allocation of experimental plot and treatment can be seen in Table4. and Fig 2.

The yield of each plot and each treatment indicated clearly depend on land productivity as shown in Table 5. and 6.

The comparison with yield and cost of fertilizer that was converted from the amount of fertilizer is shown in Fig.3.

The Fig shows that the yield increased depend on the amount of fertilizer, however increasing ratio indicated slowly in the plot of high volume applying fertilizer.

Tabel 4. Perlakuan Mulsa dan Pupuk

No.	Perlakuan	Mulsa	Pupuk (kg/ha)		
			Urea	TSP	Kcl
1	M0.A1	-	51	76	25
2	M0.A2	-	84	128	58,5
3	M0.A3	-	100	152	117
4	M1.A1	Mulsa	51	76	25
5	M1.A2	Mulsa	84	128	58,5
6	M1.A3	Mulsa	100	152	117

Fig 2. Denah Di Lapangan

M1.A3	M0.A1	M0.A3	M1.A1	M1.A2	M0.A2
M1.A1	M1.A3	M0.A1	M1.A2	M0.A3	M0.A2
M0.A2	M1.A2	M0.A3	M1.A3	M0.A1	M1.A1

M = Mulching
A = Manuring

Table 5. Pengamatan Pengaruh Penggunaan Mulsa dan Pupuk Terhadap berat Kering Kedelai kadar air 14 %

(kg/ha)

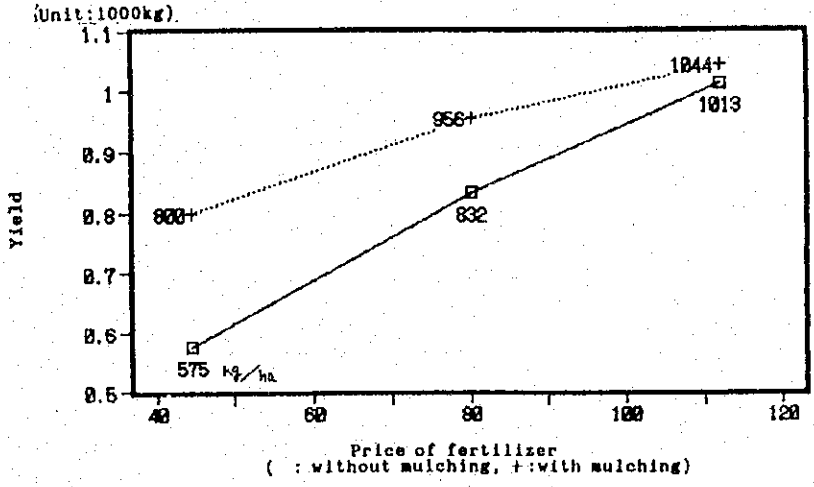
Perlakuan	Kelompok			Jumlah	Rata-rata
	I	II	III		
M0.A1	662,73	676,58	385,30	1.724,61	574,87
M0.A2	823,76	907,52	765,81	2.497,09	832,36
M0.A3	1.032,99	981,02	1.024,44	3.038,45	1.012,82
M1.A1	1.104,27	660,00	638,12	2.402,39	800,80
M1.A2	780,68	829,40	1.258,12	2.868,20	956,07
M1.A3	979,66	1.057,95	1.094,36	3.131,97	1.043,99
Jumlah	5.384,09	5.112,47	5.166,15		

Tabel 6. Analysis of Varians

(sidik ragam)

Sumber Keragaman	db	JK	KT	F.Hitung	F. Tabel	
					0,05	0,01
Kelompok	2	6.897,60	3.448,80	0,10		
Perlakuan	5	454.151,38	90.830,28	2,66		
(M)	1	72.505,59	72.505,59	2,12	4,96	10,04
(A)	2	353.675,65	176.837,83	5,17	4,10	7,56
(MA)	2	27.970,14	13.985,07	0,41	4,10	7,56
Acak	10	342.103,42	34.210,34			
Jumlah	17	803.152,40				

Fig. 3. Price of fertilizer and Yield depend on quantity of fertilizer applied (kg/ha)



2-2-2. The experiment of fertilizer requirement on corn cultivation

The sowing density was 65 cm in row width and 25 cm in intrarow spacing. Also the mixed cropping plot with Sesbania was prepared.

The applying fertilizer and eating was carried out 30 days after sowing. Table 7. shows the amount of fertilizer.

However, the damage by wild boars spread after heading date. Table 8. shows the result of yield survey, however the difference in yield was not found because of the damage by wild boars.

Table 7. Treatment

	Urea	TSP	KCL
P 1	100 kg/ha	50 kg/ha	50 kg/ha
P 2	150 kg/ha	100 kg/ha	50 kg/ha
P 3	200 kg/ha	100 kg/ha	50 kg/ha
P 4	200 kg/ha	150 kg/ha	100 kg/ha
S 0	Without Sesbania		
S 1	With Sesbania		

Table 8. YIELD OF MAIZE

treatment	block	No.of ear NO./㎡	ear weight g/㎡	weight/ear g/ear	grain weight Kg/ha
S0.P1	1	7.8	794.4	101.8	5,507
	2	6.6	611.3	93.0	4,234
	3	7.3	796.7	109.4	5,486
		7.2	734.1	101.7	5,075.5
S1.P1	1	7.0	627.3	89.5	4,276
	2	7.4	590.7	79.9	4,109
	3	8.2	686.8	83.3	4,735
		7.5	634.9	84.1	4,373.2
S0.P2	1	7.5	858.5	114.3	5,799
	2	6.8	549.5	81.1	3,796
	3	7.4	567.8	77.0	3,880
		7.2	658.6	91.2	4,491.4
S1.P2	1	6.1	592.9	96.6	4,130
	2	7.1	677.7	95.5	4,672
	3	7.8	693.7	88.9	4,735
		7.0	654.8	93.4	4,512.3
S0.P3	1	7.5	629.6	84.4	4,297
	2	7.4	737.2	99.7	5,089
	3	6.4	689.1	107.5	4,714
		7.1	685.3	96.7	4,700.0
S1.P3	1	7.0	540.3	77.4	3,650
	2	9.5	744.0	78.5	5,089
	3	6.5	618.1	94.7	4,234
		7.7	634.2	82.8	4,324.6
S0.P4	1	7.6	725.7	95.8	4,902
	2	7.1	631.9	89.3	4,359
	3	7.1	620.4	87.4	4,276
		7.2	659.3	90.9	4,512.3
S1.P4	1	8.1	716.6	88.4	4,923
	2	7.7	776.1	101.2	5,340
	3	7.1	611.3	86.7	4,234
		7.6	701.3	92.2	4,832.1

3. Subjects in the Demonstration Farm

2-3-1. Earthing on soy bean cultivation

The earthing as one of important work on soybean cultivation was demonstrated. The earthing was carried out twice at the beginning of grow and before flowering, and obtained a good result. A part of this work was done by extension workers as practical training of the Extension Workers Training.

2-3-2. Earthing on corn cultivation

The experiment of fertilizer requirement and earthing on corn cultivation in 1 ha of the field was carried out at

the end of dry season. The variety was Arjuna.

The amount of fertilizer applied were N-80 kg/ha, P-30 kg/ha and K-45/ha, one half of the whole amount was applied before sowing, the remain was applied at the time of earthing (at the time that plant length reach to knee height). The yield was 5 ton/ha.

2-3-3. Cultivation of Sesbania

Sesbania was cultivated and mixed with soil when the plant was matured. It is effected to supply the organic matter to the poor soil. The yield was around 2 ton/ha.

2-3-4. Others

2-3-4-1. Storage of seeds

It was known that the germination ratio of the seed was remarkably low when the seed of soy bean and corn for next cropping was taken by home seed-raising and stored under the high temperature and humidity.

Accordingly, the 20kg of soybean seed was stored on March last year as observation the function of the Seed storage constructed by JICA, and the germination ratio was examined on March this year.

The germination ratio at the time of storage indicate 78% (10% of moisture was contained)

3. Estate crops cultivation

3-1. The problems on estate crops cultivation in the region

3-1-1. The decreasing yield caused by dense planting of Cashew nut

The dense planting (5mx5m) was recommended for gaining settled yield from the young tree.

However, it is pointed out that the decreasing yield caused by farmers grudge to thin out the mature tree.

3-1-2. Defect of post-harvest treatment

The main estate crops in this region are listed as Cashew nut, Cacao and Pepper.

However, it is pointed out that deterioration of quality caused by the lack of drying treatment.

Especially, the Cacao harvested in the beginning of rainy season is remarkable the deterioration of quality.

3-2. Subjects in the Demonstration Farm

3-2-1. Spare planting of Cashew nut tree at Ranomeeto and Palangga Demonstration Farm

The demonstrated subject are spare planting from planting stage for settlement of the problems caused by present dense planting and cultivation of vegetables as intercropping until Cashew nut tree will grow thick for gain farmers income as a expedient ,

The planting density is 10m x 10m.

3-2-2. Cultivation in the slope land and protection of soil erosion

The demonstration subject is to plant Cashew nut seedling with the spaces of 7m x 10m prevention of soil and disasters at the terracing land reclamation.

3-2-3. Method of planting

Cashew nut seedlings were planted in the hole after getting alang-alang grass into the hole with soil and finally applying compost into the hole in dimensions of m.

Now these trees are growing smoothly.

3-2-4. Intercropping

Soybean and mungbean were planted as intercrops, however, the growth were not well without harvest caused of the mighty acid soil (pH value are around 4.).

As the improvement of acid soil was possible, however, the improvement of surface soil was not carried out for

prospect orchard caused by uneconomical.

In the rainy season of 1994/1995, upland rice was planted that have tolerance for acidic soil and come out undamaged from wild pigs. The growth was smoothly except in extremely poor soil.

3-3. Suggestion regarding post-harvest

It is necessary to make free drying treatment anytime at the proper time for prevention the deterioration of quality caused by the lack of drying treatment as mentioned above.

The power dryer was introduced to find solution of this problem, however, it is necessary to tackle this matter with establishment of a management committee for operating this machinery.

The farmers will bring primary dried cashew nut to some organization, let us say KUD, as the quantity of harvesting cashew nut is limited. Then the organization will buy it and dry up collectively. Accordingly, the products for selling standard will be ready, and if the standard goods will be shipped to the market, the farmers will gain more income without beating the price by a middleman.

4. Training activities

The training was carried out in the field of three courses such as rice cultivation, secondary crops cultivation and estate crops cultivation. And as the need arises, officials, key-farmers and farmers group training courses was carried out in each field training courses.

4-1. Officials training

The participants were agricultural extension workers who were participating from five Kecamatan (District) as the Project site. The training period was two weeks and lecture, practical training in the field and study tour in the province was programmed in the training.

4-2. Key farmers training

The training was carried out for the period of one week to aim at attracting the key farmers in the villages according to the progress of the Project activities. The training subject including practical training in the field was carried out, especially the operating a hand tractor was popular.

4-3. Farmers group training

The subjects of the training were focusing the practical training requested by farmers group for the period of one day. The training of this year was carried out in the subjects of grafting of mango and cashew nut, also upland rice cultivation for the reason that the participants came from the secondary crops cultivation area.

5. Teaching aids

Teaching aids such as video tapes, slides, text books and posters were making for training materials in corporation with the internal supporting committee in Japan.

On the process for making teaching aids, the internal committee make a draft after Experts show a draft structure to the committee, then the contents based on a draft study between Experts and members of the committee in Japan when Experts go back to Japan. After that, the contents is study with counterparts and is translated to Indonesian languages.

The following teaching aids were made.

5-1. Teaching aids making in F.Y. 1991/1992

5-1-1. Video tape

Title : Rice cultivation
Sub-title : Yield Increasing Transplanting Method

This is explained regarding the effect of yield on the difference of planting method

5-1-2. Slide

Title : Features and Improvement for Paddy Soil

This is explained regarding the origin of soil, relation between soil and water, and the power for growing rice on the basis of the slogan as "Soil is the mother of life, so let's love, cherish and improve soil".

5-1-3. Text book

a. Title : Features and Improvement of Paddy Soil

This is a text book explained the contents of slides.

b. Title : Cultivation of Soybeans

This is explained regarding the cultivation method for increasing a yield of soybeans.

5-1-4. Poster

a. Title: "Let's increase a yield of rice with soil improvement"

b. Title: "Let's increase a yield of soybean with earthing.

5-1-5. Text books translated to Indonesian languages

a. Japanese vegetable cultivation (Fruit vegetables)

b. Japanese vegetable cultivation (Leaf and flower vegetables)

5-2. Teaching aids making in F.Y. 1992/1993

5-2-1. Video tape

Title : Physiology of Paddy and Fertilization

This is explained that the basic physiology of paddy and necessity of improvement soil fertility.

5-2-2. Slide

Title : Soil of Upland Field,
- Its feather and improvement -

This is explained that its feature and function of soil for crop production and the method to increase its productive capacity and the method to prevent soil erosion.

5-2-3. Text book

a. Title : Soil of Upland Field
- Its feature and improvement -

This is a text book explained the contents of slides.

b. Title : Rice cultivation

This is explained that the process of paddy growth and the method for related works such as preparation of paddy field, transplanting, weeding, control of disease and insect damages and so on.

5-2-4. Poster

a. Title : Five Condition to improve soil productivity

This is explained that methods to increase its productive capacity and the methods to prevent soil erosion.

b. Title : Basic works to get high productivity

This is explained that the process of paddy growth and the method for related works such as preparation of

paddy field, transplanting, weeding, control of disease and insect damages and so on.

5-3. Teaching aids making in F.Y. 1993/1994

5-3-1. Video

Title : Operation and maintenance of farming machinery

This is explained regarding the operation, field work plan, daily maintenance of a hand tractor and a grass cutter etc. provided by JICA.

5-3-2. Slide

Title : Deficiencies in crops mineral elements and its countermeasures

This is explained regarding the necessity of each essential element for growing crops with illustrations.

5-3-3. Text book

a. Title : Deficiencies in crops mineral elements and its countermeasures

This is a text book explained the contents of slides.

b. Title : Cultivation of Maize

This is explained regarding the cultivation management in each growing stage on maize cultivation.

5-3-4. Poster

a. Title : Deficiencies in crops mineral elements and its countermeasures

b. Title : Explanation of each growing stages on maize cultivation

c. Title : Let's increase a yield of soybean with earthing.

Ⅱ. Modern germinated seed broadcasted rice cultivation

Now many young people leave farm to work in others place because they can gain good and sure wage while agriculturist must risk with the weather. So there is lacking of agriculture labor especially in uprooting transplanting.

So the variable cost of rice cultivation would be increase too. For this reason, the foreign country (Thailand, Philippines, Malaysia,)farmer now always chooses broadcasting method. But dry broadcasting method has problem in weed control fertilizer application. weeds will grow in the same as rice plant. When we apply fertilizer, weeds will grow better than rice. So we will get low rice yield.

To void this problem, farmer turns to germinated seed broadcasting. Not only save transplanting wage and solve weed problem but also have many advantages. For example save time in nursery process since soil preparation, nursery, preservation and uprooting.

Broadcasting method will give good quality yield, equal ripened seed, less of too young or too old seed. Because there is less tillering in broadcasting method so the panicle ripen in time and could be harvester before transplanting method 7-10 days.

At first, there is only dry direct sowing. after plowing, direct sowing dry seed. Then cover seed or may be not depend on traditional culture. In some case, it's rain too early so we can't direct sowing or it's rain too late so the directed seed rottens and is eaten by rat. So farmer should plow and direct sowing again. But in this period, the paddy fields always hold water so we direct sowing seed into water. These rice plant will not grow well. If the water is too deep, there will be less oxygen so rice root will grow short. Rice plant can't fix with soil so it will flow out and die by water wave. If we direct sowing into water 1 night and then drain

water out, rice plant will grow well. But if soil preparation isn't so good rice seed in the puddles of paddy field those held water will die and will grow well in upland place.

So the effective germinated broadcasting method should have smooth approved soil, irrigable and germinated seed broadcasting.

Advantages and disadvantages of germinated seed broadcasted rice cultivation

Advantage

1. Reduce process such as nursery, uprooting and transplanting.
2. Solve laber shortage problem.
3. High net profit per area because process reducing.
4. Rice plant isn't stunt from uprooting and transplanting
5. Earlier harvesting then trnasplanting method 7-10 days so we can sell rice yield before too.
6. High ripening percentage because there are only main panicles.

Disadvantage

1. Need a lot of time and labors in soil preparation in the first year.
2. Have a lot of weeds problems and need high cost in weeds control.
3. Need more seeds than transplanting rice cultivation.
4. Can do only in irrigated area.

Soil Preparation

Do the same as soil preparation in transplanting method. In some place we can early prepare by plowing then irrigating until soil is wet 5-10 days. Weed will grow up then irrigating, plowing and harrowing to destroy weeds. After that 4-5 days, repeat it. If we do like this 1-2 times or more, we will control weed well.

After plowing, hold water in paddy field 3 weeks so hydro grasses those are weeds like water hyacinth, Monochoria vaginalis, Presl, reed, etc can grow. (Normally, weed seed 5-7 days to germinated in still and clear water in paddy field.) After weeds grow, finely harrow soil. Weeds will flow up and collect together then take then off.

After harrowing, drain water and smoothed patches level. If we use instrument that cut and mix soil instead of plowing, should hold water in paddy field at least 3 weeks so the straw will rotten until there will be no energy. Then repeat this process. Gas from rot straw is danger for rice plant so should ventilate water and adjust patches.

Soil or patches adjusting will make convenient irrigation control, good seed germination, equal growth. Rice seed will die if it drop into puddle except the soil is high acidity. Acidity soil is easy to silt so water is clear and sunlight can pass through. But if plot is too big, there will be water ripple so rice plant will flow up easily and collect together to be cluster. Out of this, soil adjusting will help in weeds control too. The convenient method of soil adjusting can while harrow patches by use water level as measure.

Should adjust soil and patches before seed sowing 1 day so that it could sediment. If we want to sow seed, draining water out and parting paddy field. The sub plots should wide 3-5 m. and long through the big plot. Sprinkle seed the same as nursery method. The easy way to make ditch between sub plots is by penetrating or drawing earthen jar through the paddy field. So water from plots will fall down to the ditches and spraying chemical.

Seed preparation

Good seed can protect replowing from non germinated seed. Good seed should be good, vigorous and fast germinated so it will grow and cover soil surface before weeds. Good seed should be pure, equal growing and

panicle forming in the same time. Not only buy seed from Government but farmers also prepare seed by themselves by.

1. Checking seed purity.

Consider on mixed with other varieties, had insect damage, mixed with weed seed and equal size of seed. If there are other varieties seeds, insect damage and a lot of weeds seeds, shouldn't take there seeds. Choose the clean, pure and equal seed there isn't mixed with anything.

2. Germination test.

Good and vigorous germinating is necessary in germinated broadcasting method. Good seed concern with harvesting and preserving before use. If rice seed were harvested after ripening, good dried, kept in appropriate place, seed would germinate more than 80 % in 1 year.

In other cases likes harvesting before rice seed ripening enough, raining while harvesting, not dried or kept in high temperature and moisture place. Seed germination and vigorousness would reduce. So should test the germination percentage first then we could estimate seed quantity.

3. Seed treatment to eliminate fungi which are seed borne.

For example Bakanae disease, We grovel seed with Dithane M 45 in rate 2 tablespoons per 10 kg of rice. Should do before sowing about 2 weeks but not longer than 1 month because germination percentage will reduce.

4. Vigorous seed selection.

Should be perfect seed, good weigh or full grain. If using half

grain, the rice plant will slowly grow, weak, have trend to get diseases and insects. Seed selection is the necessary thing that can do by

1) Take a pail of water, put an egg down. The egg will lay by length on pail ground. Bring the egg out. Mix salt or ammonium sulphate fertilizer with water and test with egg again.

The egg will turn the round side up. Put the egg out. Mix more ammonium sulphate and test with egg again until the egg float the round side over water surface. This solution has specific gravity about 1.10. Pouring into this pail and stirring it. The imperfect seed will float to the soil surface. Take it up. Clean the sunk seed in clean water. We will use these sunk seed in broadcasting.

2) Use the winnower.

In case that can't prepare sodium chloride solution, should use the winnower.Set the high speed of winnower turning so the wind will blow the half grain out.

Seed rate

1. Soil preparation.

If we have good preparing, good patches and smooth soil level, wneed seed only 50 /ha. This rate can give high yield. If we have bad preparing, unsmooth soil level and undrainable, we should sow 100-125 kg/ha because seed would be rotten, dried, eaten by bird and rat.

2. Cover soil with seed to protect weeds.

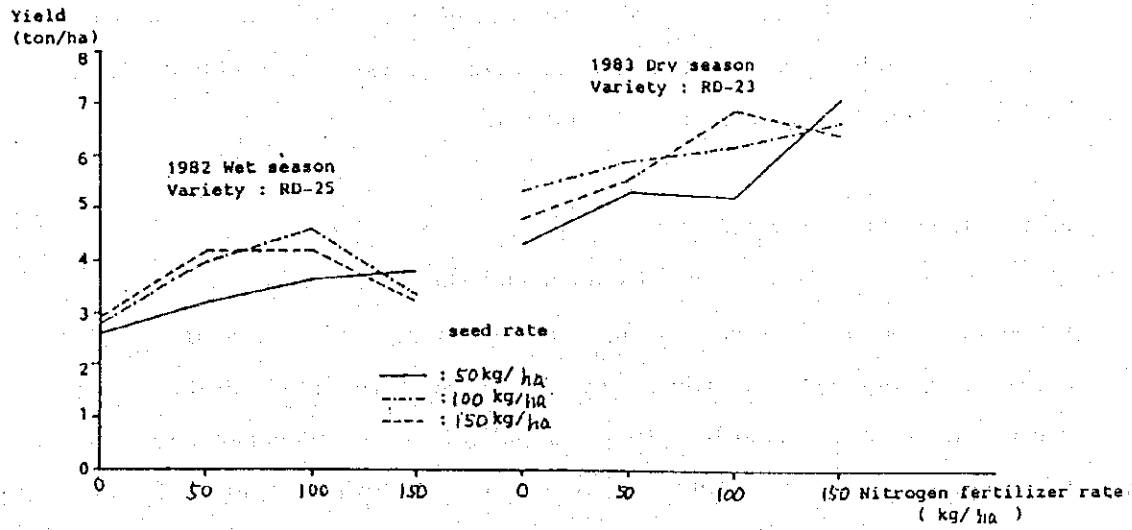
If farmer didn't have time for harrowing, they could reduce weeds problems by sowing a lot of seed. So should sow 100 kg/ha.

Direct sowing method of rice cultivation becomes popular in Central Thailand recently. Especially in dry season cultivation , majority of farmers practice direct sowing. The agricultural demonstration center conducted several experiments on seed rate of direct sowing rice cultivation.

Fig. 1 shows the rice yields affected by seed rate and nitrogen fertilizer rate in 1982 wet season and 1983 dry season. In the experiments, seed rates were 50, 100, and 150 kg/ha, and nitrogen fertilizer rates were 0, 50, 100, and 150 kg/ha. In 1982 wet season, using RD-25, seed rate of 100 kg/ha with nitrogen fertilizer of 150 kg/ha produced highest yield. While in 1983 dry season, using RD-23, seed rate of 50 kg/ha with nitrogen fertilizer of 150 kg/ha produced highest yield. Under nitrogen fertilizer rate of 0 or 50 kg/ha, seed rate of 150 kg/ha produced higher yield in 1982 wet season, and seed rate of 100 kg/ha produced higher yield in 1983 dry season. Under nitrogen fertilizer rate of 150 kg/ha, the highest yield was obtained from the seed rate of 50 kg/ha, followed by 100 kg/ha. The optimum seed rate for direct sowing rice cultivation may by affected by variety, soil fertility and cultural practices. In farmers fields, poor leveling and weeds are problems usually associated with direct sowing rice culture. At the present , seed rate of about 100 kg/ha would be recommendable to ensure good seedling establishment in the field.

Fig. 1 Rice yields affected by seed rate and nitrogen fertilizer rate in direct sowing

(Data agricultural demonstration center in Thailand)



Seed sowing

After smoothed patches and drain out water, should consider patches first. Good patches mustn't be too hard or too soft. If patches are too hard, should repeat the preparation because sowed seed can't penetrate into soil so they would dry up and die. If patches are too soft, seed should be deep sowed and rotten. So should leave for some period till soil begin to dense then sow seed. Seed should be immersed in soil only half or more than half so they should give good effect. For the adequate patches, should soak seed 12 hours and cover it 24-36 hours. The germinated seed would have root length 1-2 mm. But if patches are too soft, should cover seed longer than this so root length would be longer too. Long root will support seed from

deep immerse into soil. Scattered broadcasting will make rice plant received food elements, light and equal grown so we can get high yield. Sowing by walk on narrow ditches. Divide seed equally for each sub-plot.

In sandy paddy field, there is less soil. After harrowing and making patches, sowing seed at once and hold water in paddy field 1 night. Soil dregs will fall and cover seed then drain water out. Rice will grow well. If we drained water out before seed sowing, seed root wouldn't catch soil so it would be easy damage with sunlight.

Preservation while germination

In some area there are bird and rat. These animal will eat the sowed seed so should control them before sowing. After sowing, should check the plots if they held water. If there were water, drain it out because if not, seed would be rotten. If patches were rather hard, water in the plots would dry. Should irrigate into plot little by little. After flooding 2-3 hours, drain out until dry. When rice plant has grown 5-6 days, irrigating until water level is 2-3 cm. high or rice plants height.

Management

1. Choose sensitive rice varieties those have high stem.

   Should sow seed lately. Rice age from sowing to flowering stage should be about 70-80 days. The period of rice would reduce so rice plant would shorter because growing time was limited. So rice stem would be strength, not easy to fall down. There is no problem for non sensitive rice varieties, only harvest after rain period.

2. Water level.

   Water level for high yield should not so much especially since sowing until tillering. If deep water level, rice plant would grow high so there would be tillers because they would stretch up to avoid

shading each other. Water level in this period shouldn't deeper than 5 cm. When full tillering, water level shouldn't deeper than 10 cm. If water level was too deep, rice plant would heighten up by useless. And rice plant would easy to fall down and insects.

3. Fertilizing.

Should apply in the appropriate period and quantity.

4. Weedicide application.

Weeds are main problem of broadcasted germinated rice cultivation. If we couldn't control weeds, this cultivation would be failed. If we couldn't control weeds by these practice, should control by weedicide.

5. Diseases and insects control.

Should have diseases and insects control the same as transplanting rice cultivation especially brown rice planthopper which is the carrier of ragged stunt. This diseases reduce a lot of yield and sometimes all of yields.

Advice in paddy field fertilizing

In fertilizing, should consider on other practices those important in efficiency fertilizing and other factors which concerned as follow

1. Soil adjustment.

The first step of efficiency fertilizing is smoothing soil level. So rice plant will evenly grow. In unsmooth area, after fertilizing, rice plants in lower area always fall down. and in upper area, rice plants are rather not growing but weeds grow well.

2. Rice varieties.

We should understand characters of rice varieties. Fertilization will effect well with rice varieties those are high respond to fertilizer especially nitrogen fertilizer because it is the important one in increasing rice yield.

3. Weed control.

This factor is important for efficiency fertilizing. If we can't control weed, fertilizing and yield increasing won't be succeed.

4. Water.

There should be enough water. Rice plants need a lot of water in some period. If rice plants lack water in this period, there would be highly damage with yield.

5. Fertilizing in the appropriate period is necessary for rice plants. So we must understand growth period of rice.

Advice before fertilizing

1. Should know the area of each plot so we can calculate fertilizer weigh direct to the advised rate.

2. patches. Dress the patches to prevent leaking. So fertilizer wouldn't lost when raining. Before fertilizing should drain out until the water is only 5-10 cm.

Broadcasting method

Divide fertilizer into 2 parts. The first part is broadcasted scattered in north-south line and another part is broadcasted scattered in

east-west line. The fertilizer will scatter well through the plot so the rice plants will grow up equally.

The other practical way is marking on both of patches with bamboo stakes. This will divide plot into sections. Divide fertilizer equally and equal to the number of sections then broadcasting into each section.

Caution in fertilization and preservation

1. Don't open fertilizer sack so long time because fertilizer will be moist and cluster together. After take the need fertilizer. should tie the sack tightly.
2. Before fertilizer broadcasting, if water level is higher than 15 cm, should ventilate water.
3. Don't apply fertilizer when it rains.
4. If there is flood in fertilizing period, should wait until water level decrease.
5. If fertilizer paddy field has unsmooth level, should adjust soil level when harrowing every year until it smoothed.
6. Don't let the paddy field shortage of water more than 7 days especially, since booting stage to 10 days before harvesting.
7. Should control weeds in paddy field at least 1-2 times before second time fertilizing. This will make fertilization more efficiency.
8. Check and control rice diseases and insects and other enemies.

Rice diseases and insects germinated broadcasted paddy field

Diseases and insects germinated broadcasted paddy field are the same as general transplanted and broadcasted paddy fields which kinds of diseases and insects and the damage are different in place, season and rice varieties.

1. Choose the resistant varieties

Resistant varieties mean the varieties those are the least damage from diseases or insects and they can give high yield while there are diseases and insects dispersal. But in the same time the unresistant varieties give less yield and low quality seed.

Diseases and insects are different in each place so choose the appropriate variety. Shouldn't grow only one kind of varieties in the large area every cultivation season. Should grow many kinds of varieties alternately in each cultivation season. This can protects severe dispersal.

2. Grow in the appropriate time

Early or late growing causes different diseases for example if the growing is early, rice plants will have severe ragged stunt or severe damage from stem borer because early grown plants will be food or resort of these insects. Or growing in the inappropriate time will make rice plants heading in rainy period so rice plants will easier get brown smut than the once those heading in dry weather. Don't grow the same kind of variety all through the year because this will be the resort of diseases and insects so diseases and insects will spread every year.

3. Chemical control

Apply the different chemical follow to the kind of germs for example fungi, bacteria. If apply the wrong chemical, it won't be effect. So should apply the direct one.

4. Control by co-methods

Control by using two methods together for example grow with resistant variety and apply the chemical too. This is the best method

now because it is the effective control and economical too. The resistant variety will receive less damage from the diseases and insect. And when we apply chemical, the damage will be reduce again. Out of this, we apply less chemical than unresistant variety also.

Weed in germinated broadcasted paddy field and controlling

Weed are the important problem in germinated broadcasted rice cultivation. They will limit rice yield. Weeds have more population than rice and they can grow in the same time or before rice. If soil preparation is not so good, soil surface will hold water in some places. So some places will wet. These conditions are appropriate for each kind of weed. So there will be many kinds of weed in the paddy field. It is difficult to control these weeds by only one method. If we control by hand, it will effect rice plant too. We should consider every steps of germinated broadcasted rice cultivation since the beginning to the harvesting so weed control will be more effective. The important things in controlling are kinds of weeds, direct method of rice cultivation, management and principles in weed control in germinated rice cultivation.

Weed control

Weeds control in germinated broadcasted rice cultivation have many methods those we should consider on every step of rice cultivation.

1. Seed cleaning

   Should clean seed before broadcasting because weed seeds were mixed with rice seed when they were harvested. Separate by winnowing or soaking in sodium chloride solution that use as disease protector.

2. Plot preparation which is the beginning of rice cultivation. Should consider on

1) Plowing

Should plow when there are weeds in paddy field. This will destroy the germinated weeds those dropped from last year.

2) Harrowing

Should do after the first plowing and holding water in the paddy field for a while so that hydro weed could grow already. Should use the strong or iron harrow in order to scrape the germinated weeds and harrow the weeds those regenerating by the parts those isn't seed.

3) Patches making

Should smoother soil surface and the depth of patches because it help not only control water level but also stimulate less kinds of weeds. So it is easy to control weed after.

In plot preparation, if plowing and harrowing while the soil is drying and irrigating before seed sowing 1 day by making patches and sowing seed in the same day, this will reduce a lot of weeds because weeds will germinate after rice.

3. Seed rate can help in controlling weeds by high seed rate and low seed rate. If high seed rate, the distance between rice plant is less. If low seed rate, the distance between rice plant is big so there will be a lot of weeds. From the experiment, the rate 75-100 kg/ha is the effective rate in weed control.

4. Water level maintenance. If water level isn't equal, there will be different kinds of weeds. So, if we maintain water level, we can protect the weeds those give severe problems and let the other kinds which give less problem grow sothat we can control it easily. From the experiment, we found the different between controlling weeds and not controlling weeds was not significant because this experiment was done

in experiment station area that could irrigate well.

5. Herbicides are more useful now because of efficiency of the chemicals, agriculture labor shortage and high wage of labor. And in the future time, herbicides will be more necessary in increase cultivation area too.

Herbicides are toxicity chemical. so be careful when apply them. In this kind of rice cultivation, the chemicals mustn't harm rice plant. The kind of chemical follows to the kind of dispersed weed, toxicity(to rice plant), Price and human safety from the chemical.

1) Kind of herbicide.

There are many kinds those control different kinds of weed. So we make the experiment and conclude the result in table 1 and 2.

2) Chemical condition.

There are many conditions those easy to dissolve and convenient to apply. The popular conditions are liquid, powder and granular.

3) Application period.

There are 2 periods in normal case. We can choose one from 10-15 days after seed sowing (they always apply at 10 days after seed sowing) or 20 days after seed germinating (weed will have 3-4 leaves). If we choose the first period, we will apply by sowing (granular type) or mixing with sand and then sowing (liquid type) when water in paddy field is palm hand deep. If we choose the second period, should drain out until there is the least water then apply the powder chemical or spray the liquid chemical sothat weeds will receive the most of chemical.

4) Chemical rate.

If we apply too much of chemical, it will be dangerous for rice plant. So,should apply followed to the advisory rate. If we don't apply direct to the advice, there will be many problems like weeds

can grow well or weeds and rice plant are all eradicated.

5) Be careful in application as follows.

(1) Read and understand the label beside the chemical container.

(2) Keep the chemicals separately. Keep far from children, food and animals.

(3) Chemical container must always have the label.

(4) Don't touch with chemical by using the protector.

(5) Don't stir with hand when mixing chemical with water.

(6) Don't suck the squirt when it is plugged.

(7) Don't let the chemical blow into other plants area, irrigated canal, river and canal while spraying.

(8) Don't let the spray touch animal.

(9) No smoking while spraying the chemical.

(10) If chemical blow into eye, should wash with a lot of pure water.

(11) Take a bath after spraying.

(12) Wash the container after spraying.

(13) If there is allergic to the weedicide, go to see the doctor at once.

Weed control won't be perfect if we practice only one method. We should practice many methods together for example soil preparation and herbicide or many herbicides mixed together sothat it would be more efficient than one chemical. We should know direct practices and knowledge of weeds so we can control weeds more than 80%.

Each herbicide kills weeds in different manner, so that farmers should carefully decide the kind of herbicide and follows the instruction of usage. There are many kind of herbicides. Some of their common names and trade names are as follows:

Common name	Trade name
1. Benthiocarb	Saturn
2. Bifenox	Modown
3. Butachlor	Machete, Chelete
4. CNP	Mo
5. Ioxynil + 2,4-D	Actril DS, Actril DR
6. znitrofen	Tok-E 25
7. Oxadiazon	Ronstar
8. Propanil	Propanil C.T., Stam F.34, Bara F100
9. 2,4-D	Shell-D 80, D-M-A-6, Ester 79, Edsanchor, Twindronal, Twin 2,4-D, Bara-ester
10. 2,4-D + Oxadiazon	Ronstar 2 D
11. 2,4-D + Propanil	Same as 8. and 9.

Kind of herbicides and their effects

	Common name								
	1.	2.	3.	4.	5.	6.	7.	8.	9.
Goose weed	F	G	F	E	E	E	E	N	N
Mimulus orbicularis	P	G	P	F	E	G	E	N	P
Sedge	E	E	E	E	E	E	E	F	G
Tall-fringe-rush hoorah grass	E	E	E	E	N	E	E	F	E
Nut sedge	E	E	E	E	E	G	E	F	E
Raygrass	G	G	G	G	F	G	G	G	N
Barnyardgrass	G	G	F	G	F	E	E	E	P
Jungle-rice	E	E	G	G	F	E	E	E	N
Stone wort	G	P	P	P	N	E	G	N	N
Water clover	P	F	P	P	E	P	G	N	N
Monochoria	G	G	G	E	E	G	G	P	G

E: EXcellent control

G: Good control

F: Fair control

P: Poor control

N: No control

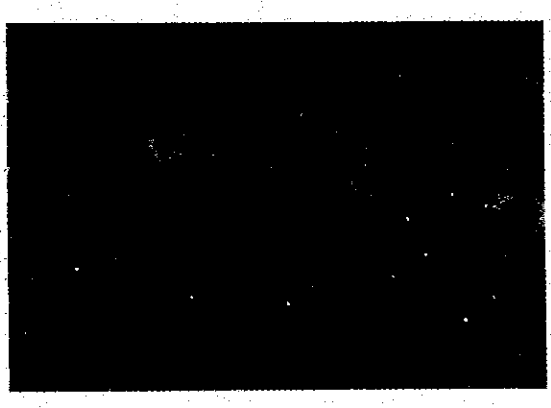
From: Technical Document RICE, Agriculture Promotion Department. Thailand.

Name of herbicides in germinated broadcasted rice cultivation.

Common name	Trade name	Condition	gm.a.i./ha	a.i.	gm.product/ha	Days after seed sowing	Toxicity	LD 50 mg/kg
1. CNP	MO	Liquid	2,000	20 %	10,000	10	Mild	10,800
2. 2,4-D + Oxadiazon	Ronstar 2D	Liquid	1,000	16.6 %	6,024	10	Mild	3,500
3. Nitrofen	Tok E	Liquid	2,000	25 %	8,000	10	Mild	2,630
4. Benthiocarb	Saturn	Liquid	2,000	50 %	4,000	10	Mild	1,289
		Granular	2,000	8 %	25,000	10	Mild	1,289
5. Butachlor	Machete	Liquid	1,000	60 %	1,666	10	Mild	1,200
		Granular	1,000	8 %	12,000	10	Mild	1,200
6. Bifenox	Modown	Liquid	2,000	40 %	5,000	10	Mild	6,400
		Granular	2,000	10 %	20,000	10	Mild	6,400
7. Oxadiazon	Ronstar	Liquid	750-1,000	25 %	3,000-4,000	10	Medium	3,500
8. 2,4-D	Esteron	Powder	750	76 %	987	20	Mild	375
	Seter	Liquid	750	78 %	962	20	Mild	375
	DMR	Liquid	750	78 %	962	20	Mild	375
	Hedonal	Powder	750	-		20	Mild	375
	Shell D 80	Liquid	750	80 %	938	20	Mild	375
	Linomone	Liquid	750	-		20	Mild	375
9. 2,4-D + Propanil	The same as 8, 11		750-1,500	-		20	Mild	375
10. 2,4-D + Loxynil	Actril DS	Liquid	1,000	70 %	1,429	20	Medium	375
11. Propanil	Stam F 34	Liquid	2,000	34 %	5,882	20	Medium	1,384
	Rogue	Liquid	2,000	64 %	3,125	20	Medium	1,384

* No.1-7 are pre-emergence herbicides.
* No.8-11 are post-emergence herbicides.

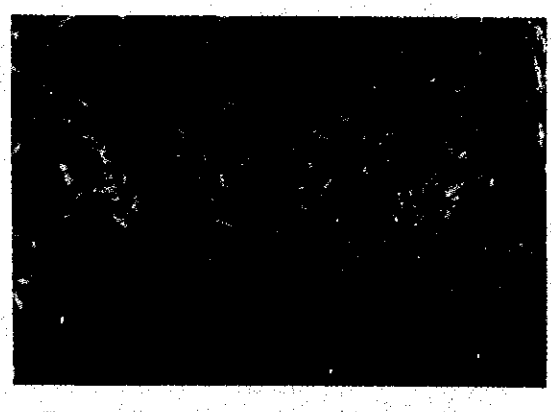
Sphenoclea Zevlanica Gaertn.
gunda, gunda padi, gunda rawah,
(Goose weed)



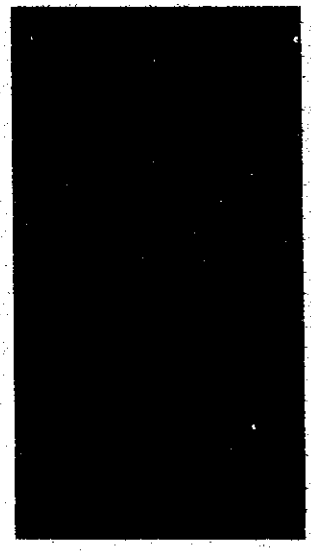
Minulus orbicularis Benth.

Monochoria vaginalis (Brum. f.)
Presleceng, eceng padi, bengok,
(Monochoria)

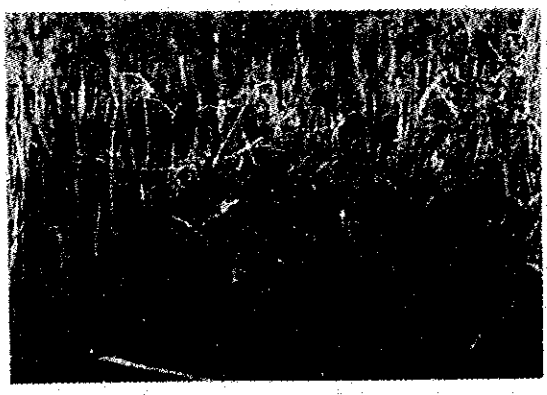
Echinochloa crus–galli (L.) P. Beauv.
padi burung, jajagoan, jawan,
(Barnyardgrass)



Echinochloa colonun (L.) Link
rumput kusa–kusa, jajagoan leutik,
(Jungle–rice)

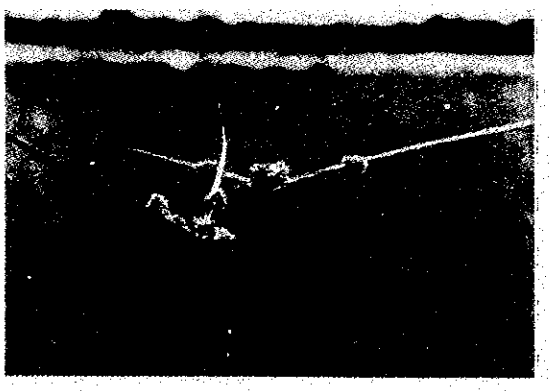


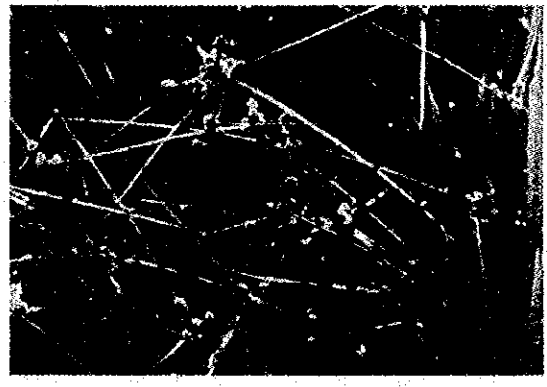
Leptochloa chinensis (L.) Nees
bebontengan, timunan,
(Raygrass)



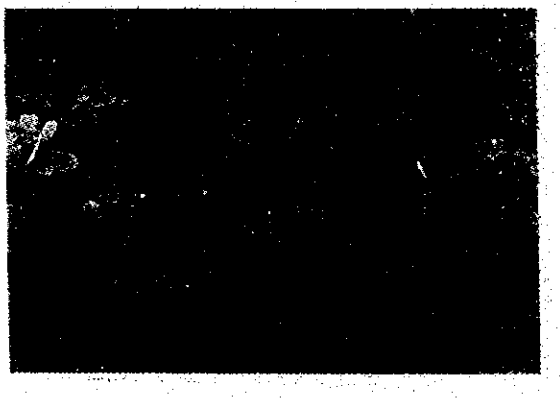
Cyperus pulcherrinus (L.)
(Nut sedge)

Finbristylis niliacea (L.) Vahl
babawangan, adas-adasan,
(Tall-fringe-rush hoorah grass)





Cyperus Jiffornis L.
jebungan, ramon, brendelan,
djukut pendul,
(Sedge)



Marsilen crenata Presl
semanggi,
(Water clover)