10) Others

(1) Management of funds during the exploration

It is necessary to have a funds manager in an exploration team. The roles of managing funds should be determine at the onset of the exploration. The funds manager is in charge of payment for cost of local staff, drivers, guides, porters and so on.

(2) Necessary work after exploration activity at a location

Before completing the exploration activity at a location, one should verify the contents of the samples and sort and separate the collected material with the local staff. Make sure that any omission or misspelling in the collection forms is corrected. In the case of a joint-exploration, discuss the separation and management of the collected material with the local staff and verify what their evaluation is, and make sure the future plans of collection is clear.

Later, have a final meeting or a dinner party at an appropriate occasion and to thank the local staff.

(3) Appreciation to the farmers

The farmers play an important role in explorations. Don't invade the farmers' fields without permission as if they were one's own. If someone is there, be sure to approach him/her, and then confirm together he/she is an owner or not. Explain politely one's intention to the farmers and obtain permission for making a collection. Try to get a collection without having to make any compensation and so avoid paying money or other articles for compensation. One's visit is not necessarily always welcomed by the farmers. Even if one feels the farmers are being awkward, behave open-mindly. For them uninvited guests appear suddenly. Therefore, always express one's appreciation.

(4) Local staff

Ideally, the local staff should join in on the exploration mission from preparatory meeting. Prior to departure confirm with the local staff that they are familiar with the objectives of the mission and what expenses will be incurred. Generally, the expenses will be for lodgings and transportation at local areas are covered by a host institute. The exploration of plant genetic resources

means that we can obtain a number of excellent research colleagues to establish coordinate relations with each other in the future even when the exploration activity is completed.

(5) Meals and drinking water at local areas

During an exploration activity it is best as a rule, to take the local meals. Because they are suited to the natural features of the region. If one records the menu of every meal, these records will be helpful for the future exploration and understanding of the important plants and crops of the region. Be careful of drinking water. In the field survey in local areas the drinking water is the main cause of illness. It is important to get an injection of gamma-globulin, however, one should take care of health every day at local areas. When drinking water is dirty, drink it after sterilization. It is surprisingly more unusual to become ill in the villages than in urban areas.

11) Plant quarantine inspections

When traveling abroad collected plant materials will be inspected by the plant quarantine officials at the leaving and entering a country. As this item is usually not necessary to explain in domestic explorations, the rest is omitted.

12) Exploration report

When a report of the exploration realized in the paper, the field work will meet a final goal. Submit a manuscript of exploration report immediately to an appropriate organization or an editorial board concerned.

The manuscript should contain following contents.

(1) Title
(2) Authors and organization
(3) Term, itinerary, major exploration areas
(4) Purpose, contents, results
(5) Useful information for the next survey
(6) Impressions
(7) Future plan of managing collected samples

Tables and figures should at least be attached as follows.

(1) Itinerary
(2) Collection list, i.e.summarizing tables (Fig.3)
(3) Map of exploration area
(4) Cooperating organizations

13) Epilogue

After coming from an exploration, do not forget to send a letter of thanks. This is an important task for the future exchange of information. Finally we would like to consider the importance of an exploration. There are many purposes in an exploration which can be considered. Loss of the valuable genetic resources present on the earth, will consequently be a great loss to mankind. From this point of view, several explorations of species will be carried out according to their vulnerability to extinction. Accordingly, the exploration of the species facing extinction should be practiced selectively from the regions containing the diversity of the species.

On the other hand, some species are considered to be safe at the present, and therefore there is no urgent requirement to collect such species. The best way to conserve any species which is readily available is to leave them *in situ*, as they will be in natural environment and it is also more cost effective. The most effective way of genetic resource conservation is that those rich-genetic resource countries themselves explore and conserve the resources in their countries.

Before concluding this manuscript we want to discuss what actually is a genetic resource and to whom do genetic resources belong to. The role of genetic resources will be accomplished if one finds just one gene or allele which can be utilized as breeding materials. In this sense, genetic resources belong to plant breeders, and ultimately to the wholes of mankind. However, such a statement sounds idealistic. We should remember at the same time that the materials we want to explore belong to the farmers. Exploration activity is dependent on the cooperation of the farmers who have been conserving their crops for a long long time.

14) Cautions and summary

(1) Choose the mission members, transportation and length of exploration well.

(2) Have preparatory meetings fully, assign each role and check equipment before departure.

(3) Submit planning form regarding the introduction of genetic resources to the plant quarantine office.

(4) Collect 50 seeds each randomly from 50-100 individuals in one site.

(5) Make up one collected sample by taking seeds from 50 individual (if no variation) or 100 (if significant variation) [Seed crops].

(6) Make up one sample by collecting the same organ of 10-15 individual of tuber crops [Wild species].

(7) Make up one sample of a tuber growing cultivars by collecting an identical clone in a village.

(8) When seeds can be obtained, collect them randomly, if possible [Fruits].

(9) If possible, make selective sampling besides non-selective sampling.

(10) Choose the collection sites widely, and select them on the bases of their environmental conditions.

(11) If available, collect samples from various sites.

(12) If necessary, make herbaria.

(13) Fill in the collection forms and summarizing table at the exploration sites.

(14) Scions must be sent urgently ensuring that they are preserved properly.

(15) Express gratitude to the farmers as collecting is dependent on their cooperation.

(16) Remind that officials of the plant quarantine office are our colleagues.

(17) Make exploration report as quickly as possible.

(18) Collected materials should be sent to appropriate research groups for primary evaluations and to gene banks for long- term preservation as base-collections as early as possible.

(19) In case of emergency, contact the appropriate organization.

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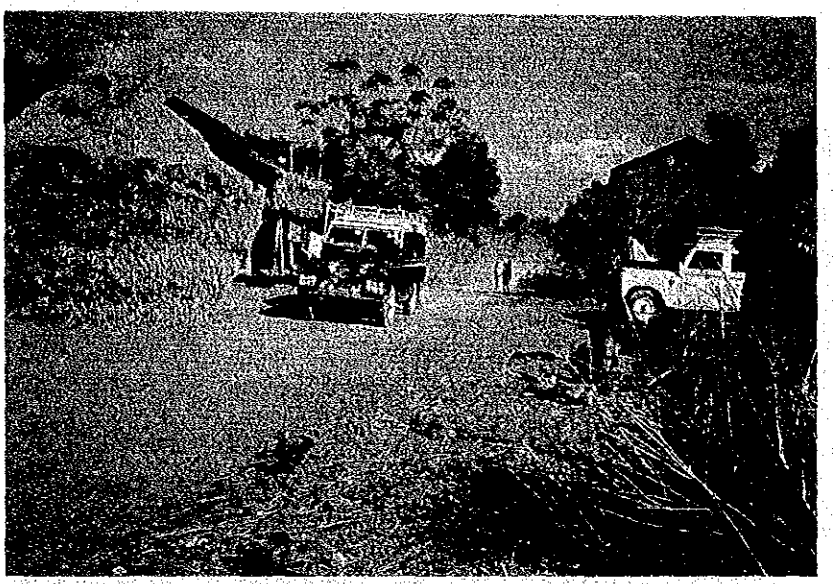
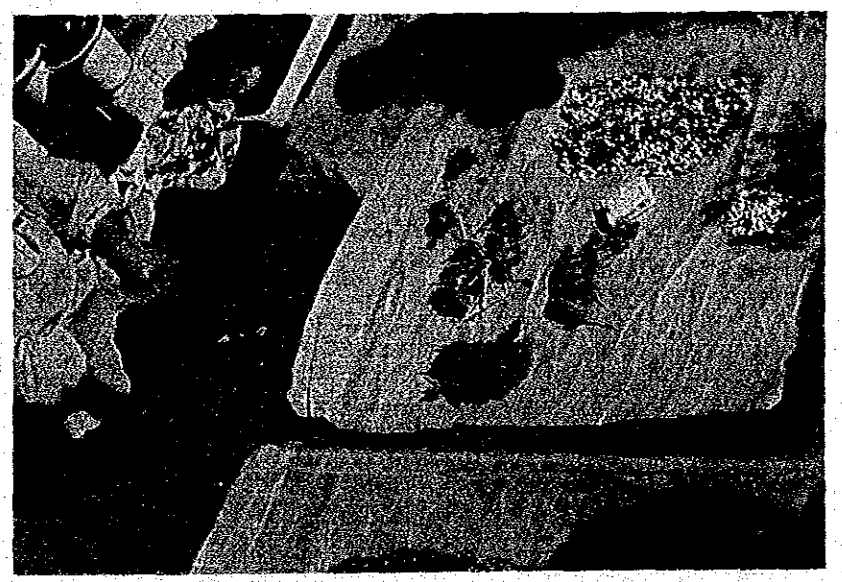


The collection mission visiting a village in eastern Nepal

Arranging collected materials at a camping site in western Nepal

Various genetic resources being dried on roof of a farmhouse in western Nepal



Hearing on the collected materials at entrance of a farmhouse, Gunma Prefecture, Japan

II. Reports from Exploration and Collection of Native Germplasm in Japan

1. Collection and Evaluation of Land-Races of Maize Germplasm in Japan

   by Minoru YAMADA
   National Grassland Research Institute

2. Collection of Crop Genetic Resources in the Central Parts of Japan in 1987

   by Mitsunori OKA, Tsukasa NAGAMINE, Yoshinobu EGAWA, Masumi KATSUTA and Masahiro NAKAGAHRA
   National Institute of Agrobiological Resources

3. Collection of Local Germplasm of Cruciferous Vegetables and Others in the Kinki Region in 1986

   by Hiroaki YOSHIKAWA, Hiroshi YAMAGISHI and Susumu YUI
   National Research Institute of Vegetables, Ornamental Plants and Tea

II – 1. Collection and Evaluation of Land-Races of Maize Germplasm in Japan

by

Minoru YAMADA

National Grassland Research Institute

CONTENTS

According to a past record, maize, *Zea mays* L. was introduced to Japan by Portuguese during the period of Tensho Era(1573-1591). The name of maize is found in a chronicle, 'Seiryo-Ki' by Lord Seiryo DOI (1546-1629), which referred to a note that maize should be harvested in August. No other information on maize cultivation is available before that period. Maize was also introduced to Japan about one hundred years ago during the Meiji Era(1868-1912). The Caribbean flint type of maize was first introduced by the Portuguese, and Northern flint and dent types were introduced during the Meiji Era. The landraces adapted to Japan are considered to be derived from those introduced in the two periods. Introduction and distribution of maize in Japan are depicted in Fig. 1 based on the data obtained in a series of collection tours.

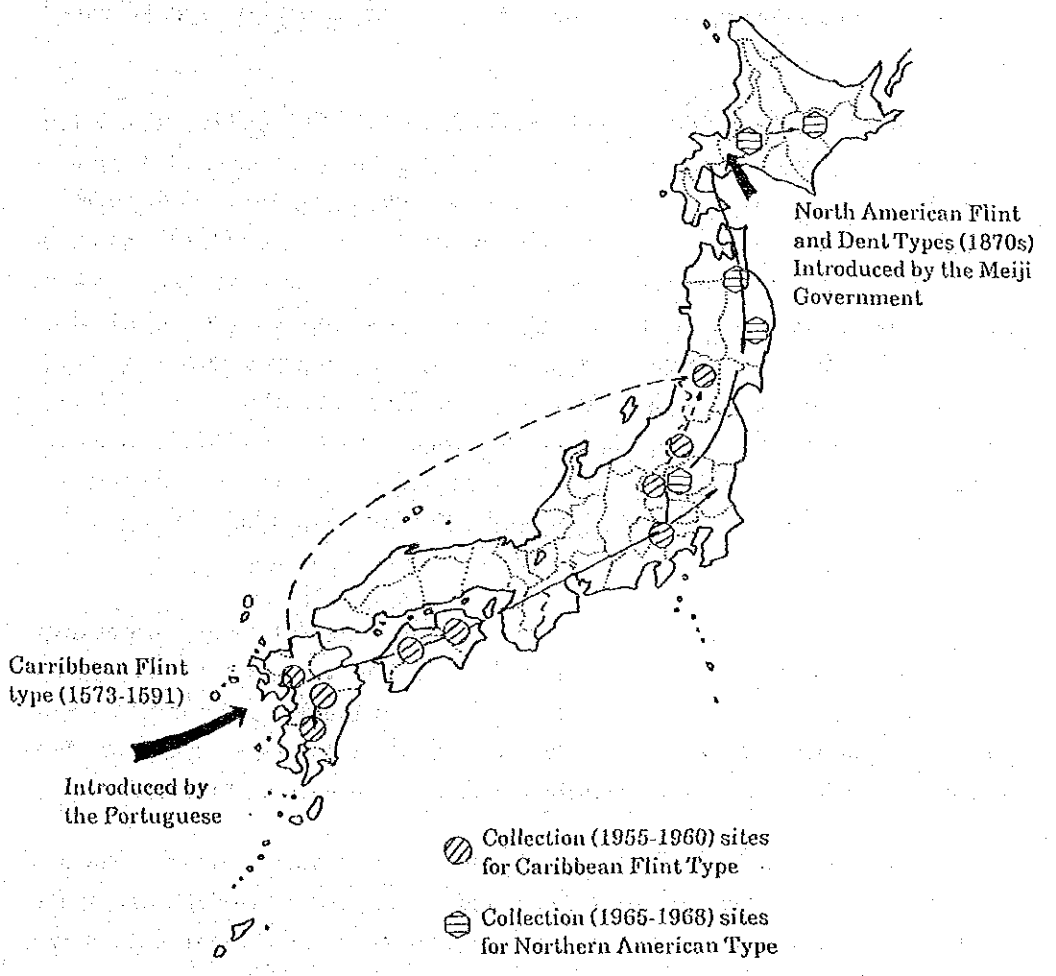


Fig. 1 **Introduction of maize to Japan and distribution in Japan** (YAMADA 1987)

1) Collection of land-races in Japan

The maize breeding program in national organizations was initiated in 1938 and is presently continued at four stations with two institutes assisting the breeding stations. Maize germplasm has been collected by national and regional organizations.

Collection of maize, which mainly comprised land-races of flint type, was conducted from 1955 to 1968 at the National Institute of Agricultural Sciences (NIAS, reorganized in 1983 into the National Institute of Agrobiological Resources, NIAR, in Tsukuba, Ibaraki). The project has covered land-races at more than seven hundred sites, some of which were at the foot of Mt. Fuji, and in the regions of Shikoku, Kyushu, northern Kanto, southern and northern Tohoku.

Expeditions for collecting maize at the foot of Mt. Fuji and in the Shikoku and Kyushu regions were conducted from 1955 to 1960, and those in the regions of northern Kanto, southern and northern Tohoku were from 1965 to 1968 (Table 1). After the collection, the materials were planted in the field of the Division of Genetics, NIAS, at Hiratsuka, Kanagawa, and at three other experiment stations to evaluate their characteristics. Seventy-one characteristics including both botanical and agronomic ones were recorded, although information on some characteristics of the materials from northern Kanto, southern and northern Tohoku was not available. In addition, cytological observations of chromosome knobs and supernumerary chromosomes in pollen mother cells were conducted for the materials collected at the foot of Mt. Fuji and in Shikoku and Kyushu regions.

The chromosomal morphology of these materials was commonly characterized by the position of knobs on the long arms of the III, V, VI, VII and VIII chromosomes, and only some of the materials at the foot of Mt. Fuji showed presence of supernumerary chromosomes. Based on these observations, the Japanese flint land-races were identified to be the Caribbean flint type.

The materials from the region of northern Kanto and northern Tohoku included some land-races which were derived from North American flint types introduced to Hokkaido during the Meiji Era. These materials were characterized by a unique ear type of 8 rows and brown kernel.

Table 1 Collection projects and sites

Site of project	Relating prefecture	Date	Staff member	Numbers of farmers	Number of land-races collected	Numbers of accession in NIAR
The first of the foot of Mt. Fuji	Kanagawa, Yamanashi, Shizuoka	Nov. 1955	T. Suto Y. Yoshida	79	79	49
The first of Shikoku region	Ehime Kochi	Feb. 1956	T. Suto	76	78	15
The first of Kyushu region	Ohita, Kumamoto, Miyazaki, Kagoshima	Nov. 1956	T. Suto M. Tohyama	97	97	4
The second of the foot of Mt. Fuji	Kanagawa, Yamanashi, Shizuoka	Oct. 1957	T. Suto M. Tohyama N. Mochizuki	35	35	5
The second of Shikoku region	Ehime Kochi Tokushima	Nov. 1957	T. Suto S. Sugiyama	176	191	12
The second of Kyushu region	Nagasaki, Kumamoto, Miyazaki, Kagoshima	Oct. 1958	T. Suto N. Mochizuki	78	96	30
The third of the foot of Mt. Fuji	Shizuoka	Mar. 1960	N. Mochizuki	14	14	1
The Northern Kanto region	Gumma, Ibaraki	Oct. 1965	N. Mochizuki M. Yamada	33	35	34
The Southern Tohoku region	Fukushima	Oct. 1967	M. Yamada	31	31	31
The Northern Tohoku region	Yamagata, Iwate, Aomori	Oct. 1968	N. Mochizuki M. Yamada	38	38	35
Others	–	–	–	–	6	–

The land-races collected by the national organizations are preserved at the Seed Storage Laboratory, NIAR at Tsukuba for breeding and genetic studies. As shown in Table 1, a large number of materials collected at the foot of Mt. Fuji and in Shikoku and Kyushu regions were lost because storage facility was not available at that time. As mentioned above, the explorations by the national organization have been conducted from 1955 to 1968. Missions, covered areas, periods, staff members concerned, numbers of farmers who provided samples, numbers of samples, and numbers of accessions in the NIAR, are shown in Table 1.

2) Some details of the exploration by NIAS

The exploration project was started in 1953, when Dr. T. SUGI at the Bureau of Improvement of Agriculture, MAFF made an original plan with a support of national budget for 1954 (in private communication). His plan was based upon Dr. T.SUTO's proposal for starting his work on maize genetics in NIAS. Following Dr. SUTO's idea and discussion with Dr.YAMASAKI, one of the pioneers of maize breeding in Japan, Dr.T. SUGI decided the project to collect Japanese land-races and to determine their combining ability with American dent lines. Since then, the breeding strategy has been followed by breeders.

(1) Exploration method

The exploration was conducted at two steps from 1954 to 1960 as follows :

At the first step, instead of choosing any places for collecting land-races without reliable data, the mission had collected information as much as possible from agronomists at local agricultural experiment stations and volunteering technical workers. In the collection activities, members of the missions obtained detailed information from leading farmers in a variety of areas. The mission chose typical ears based upon experiences of leading farmers. Leading farmers were asked to provide three ears from a lot of field or from a land-race.

At the second step, after scientists had tested sampled land-races in fields, the obtained data were analyzed to identify land-race groups, to which each of the samples belongs. Then the members of collection team again took trips to some areas for collecting additional lines, which may belong to tentatively designated leading land-races.

The missions from 1965 to 1968 had finished only the first step of the exploration. They expected that the collection was made avoiding any assumption leading to bias.

The missions always conducted hearing from farmers who provided their samples. The recorded items were as follows: local names of samples, seed sources, planting procedures, harvesting and processing methods for seed multiplication, cropping systems, and home-economics. To record farmers' information in detail, members of the mission showed prepared questionnaire sheets to farmers. After returning back to the institute, members of the mission reviewed the explored areas using their record.

Characteristics of the collections were recorded in the institute immediately after tours, and that step was followed by field trials in next season at three agricultural experiment stations and NIAS. Characteristics observed were seventy-one or a bit less than that for all the collected materials, as shown in Table 2, including four traits for flowering, six for stalk, nine for leaf, eleven for tassel, sixteen for ear, four for shank and husk, eleven for cob and ten for kernels.

As is well known, identification of chromosomal patterns is one of the most reasonable criteria to investigate the differentiation, classification, relationships among lines, and origin of maize. MC CLINTOCK *et al.*(1981) cytologically analyzed the chromosomal morphology of maize in their studies of origin of maize in Mexico and the neighboring countries.

In this exploration, number of knobs in all the chromosomes, arms of chromosomes having knob and numbers of B chromosome were observed for five plants of each line. Immature tassels speculated at meiosis by finger-touch before tasselling were sampled and several florets were dipped into fixing solution of acetic-acid and alcohol. After the fixation for 24 hours, samples were put in refrigerator with fresh fixing solution. Cytological observation of samples was conducted at pachytene of first meiosis by smear method, and the type of knob and B chromosome was determined.

Table 2 Characteristics observed in the institutions

Organs	Characters
On flowering	Tasseling date (beginning), Tasseling (fully), Silking (beginning), Silking (fully)
On stalk	Stalk length, Plant height, Stalk diameter, Prop-root height, Number of tillers
On leaf	Leaf length, Leaf width, Number of leaves, Number of fresh leaves, Number of veins per leaf, Pubescence of leaf sheath, Leaf brade color, Leaf sheath color, Leaf area
On tassel	Tassel length, Peduncle length, Length of branching space, Length of central spike, Length of longest tassel branch, Number of tassel branch, Relative density of branches, Pendency of tassel, Number of spikelets, Number of fasciated spikelets, Spikelet length
On ear	Exerting length of ear in axil, Ear height, Ear length, Ear diameter (base, mid and tip), Length of sterile ear tip, Row number, Number of kernels in row, Estimated number of total kernels, Ear weight per plant, Crooking index of ear, Twisting of rowing, Irregularity of rowing, Ear quality, Glossiness of ear
On shank and husk	Shank length, Shank diameter, Length of husk brade, Number of husk
On cob	Cob diameter, Cob weight, Pith diameter, Rachis diameter, Rachis induration, Rachis color, Cupule depth, Rachis flaps, Texture of lower glume, Shape of lower glume margin, Pubescence of lower glume
On kernels	Kernel length, Kernel width, Kernel thickness, Volume of kernel Kernel weight per plant, 100 kernel weight, Kernel denting, Hardiness of kernel, Kernel striation, Kernel color

(2) A case of the collection trips

In every collection trips, we carried field-notes and took records at every collection sites as mentioned before.

The author engaged in collection trips in northern Kanto, southern and northern Tohoku in 1965 to 1968 (Table 1). From the experiences, the author would like to describe some details of the collection procedures herewith.

a. Pre-tour planning through published data.

The following data were usually collected in planning, and recorded in field notes.

a) Geographical maps on the scale of 1:25,000 published by the Geographical Survey Institute, the Ministry of Construction, b) Agricultural census, c) Local climate data, and d) Local statistics published by town or village offices to be visited. Based upon these data, collection routes, outlines of topography, cropping season of maize and so on, were described in field notes for confirmation at collection sites.

b. Records to be taken in the collection sites are as follows:

a) Geographical data
(a) Altitude and inclination, (b) annual average air temperature, (c) annual precipitation, (d) edaphic features, soil types, origin of soil and soil fertility.

b) Cultivation data
(a) Cropping systems (multiple or mono-cropping) and kind of preceding crops, (b) tillering methods (hand or machinery), (c) planting date after preceding crops, (d) planting density with row-width and hill distance in cm, numbers of seed in a hill, and thinning at seedling stage, (e) fertilizer application in regards to basal compost, manure, and chemical fertilizer, top-dressing in any kind of chemical fertilizer.

c) Harvesting time and method
(a) Processing after harvest for grain use or seed.
(b) Drying naturally or artificially.

d) Cropping system
Mono-culture of corn, double cropping, or mixed-planting with any kind of crops.

e) Types of utilization
In regards to food, feed, or sale and any style for use.

c. Methods for sampling of ears :

In the collection, the author with local agronomist(s) called on farmers or leading farmers who were cultivating corn. The author asked them to indicate ears of typical land-races among samples grown at a site. Farmers chose three

sample ears upon their criteria. When a farmer planted more than two types, sample ears were more than two groups.

d. A collection trip in the southern Tohoku region

The author visited four towns and five villages in the south-western area of Fukushima Prefecture in southern Tohoku region, in October in 1967. Ear samples were provided from thirty-one farmers as shown in Fig 2.

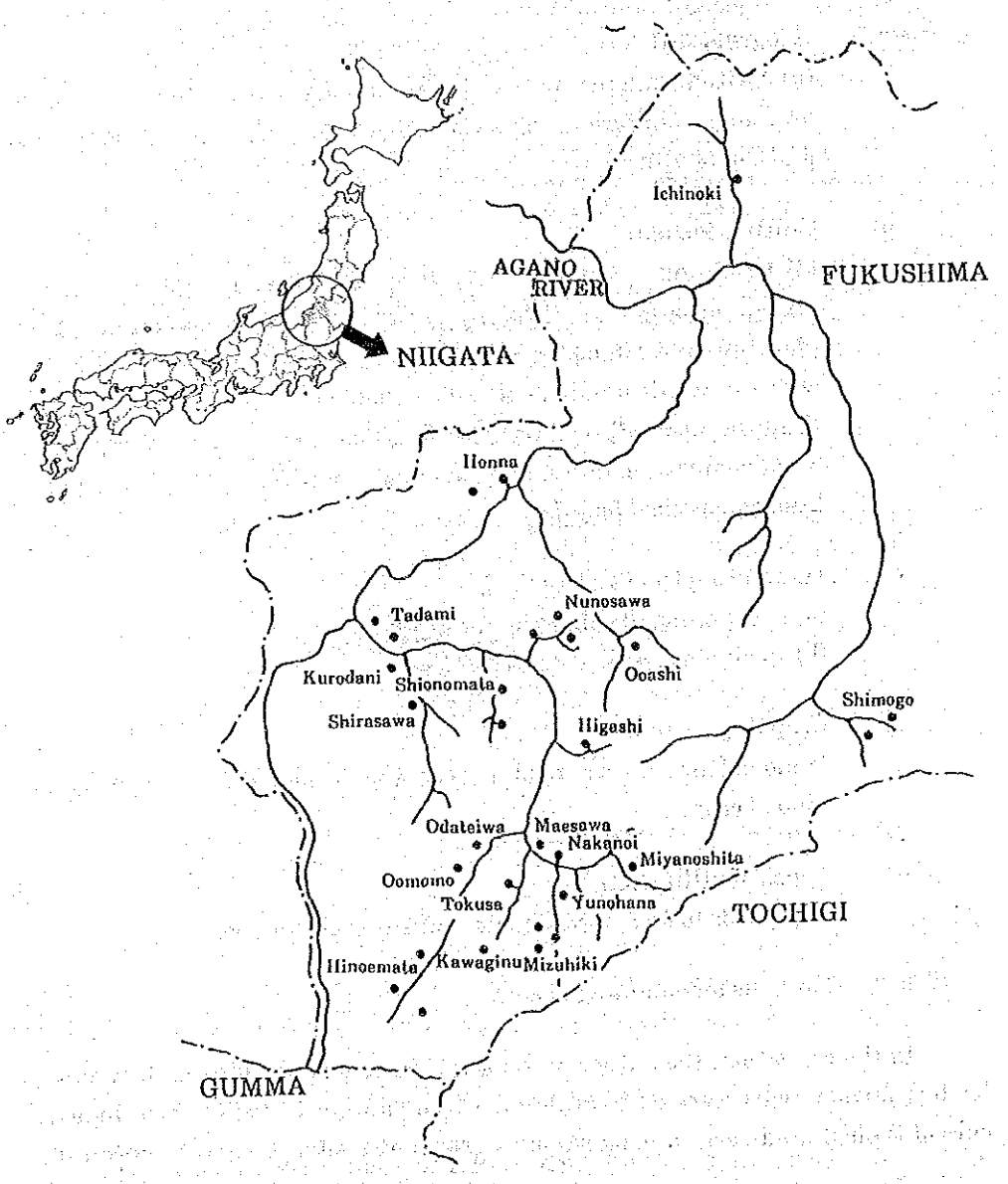


Fig. 2 Collection sites in Fukushima Prefecture

The site for collection is surrounded by mountains except to the east. The altitude of the area ranges from 380 to 940m above sea level with slopes and valleys. The annual average temperature in most of the site is below 10 °C, especially at Hinoemata 8.5 °C, and it is similar to that in Zurich, Hamburg, La Paz and Buffalo near Toronto. The annual precipitation is 1,400 to 2,000mm with heavy snowing. Soil of the area is diluvium or of volcanic origin with clay or loam clay.

Because of heavy snowing, tillering with hand or machinery starts after snow melting. Seeding is practiced at the end of April to the middle of June, irrespective of altitude of the site. Two to five kernels in a hill are seeded and only a plant is grown after thinning. Planting density is 22,000 to 66,000 plants/ha, with a row width of 45 to 90cm, a hill interval of 30 to 60cm, and a common row-width of 60cm. The hill intervals on row-planting are adjusted to 30 to 60cm by thinning seedlings. For basal fertilizer, compost or manure was applied with some sorts of chemical fertilizer. Top-dressing is practiced depending on plant growth with certain fertilizer, ammonium sulphate or compound chemical fertilizer. Cropping system in the area is mostly mono-culture due to heavy snow fall, and mixed-planting with cowpea, carrot, or pumpkin, is rarely practiced.

Harvesting time is from the end of August to the middle of October, depending on farming and the earliness of land-race. After harvest, ears are dried on hanging and threshed by hand or hand sheller, or Morokoshi-mogi in Japanese local tongue. In the area, maize kernel is cooked for human consumption, as roast flour which is called as Kosen or Kogashi in Japanese, or by boiling slowly for paste. It is also used to feed cattle or chicken.

3) Cytological observation on land-races collected in southern Japan

Some results of chromosomal morphology obtained by observation of maize varieties of all over the America (MC CLINTOCK *et al.*1981) are regarded as key criteria for classification of maize. For the Japanese land-races shown in this text, chromosomal observations in terms of existence of B chromosome(s), position of knob(s) and number of knob(s) in the chromosome were conducted on the pachytene phase of pollen mother cell at meiosis. Eight land-races each were chosen by Dr.T.SUTO from the foot of Mt. Fuji, Shikoku and Kyushu region as the

Table 3 Observation on chromosome characteristics in *maize of Japanese land-race*

Name of land races	B chromosome	Chromosomes I Short arm	I Long arm	II S.	II L.	III S.	III L.	IV S.	IV L.	V S.	V L.	VI S.	VI L.	VII S.	VII L.	VIII S.	VIII L.	IX S.	IX L.	X S.	X L.	Total Short arm	Total Long arm
(At the foot of Mt. Fuji)																							
Jurigi	−	−	−	−	−	−	1	−	−	−	1	−	2	−	−	−	1	−	−	−	−	−	5
Hirano	+	−	−	−	1	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	−	−	6
Doshi	+	−	−	−	1	−	1	−	1	−	1	−	2	−	1	−	2	−	−	−	−	−	9
Akiyama	−	1	1	−	1	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	−	1	9
Narusawa	+	−	−	−	1	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	−	−	7
Suginazawa	−	−	−	−	1	−	1	−	−	−	1	−	2	−	1	−	2	−	1	−	−	−	9
Iwama	−	−	−	−	1	1	1	−	1	−	1	−	2	−	1	−	2	−	−	−	−	1	9
Kamigane	+	−	−	−	1	1	1	−	−	−	1	−	2	−	1	−	2	−	1	−	−	1	9
(Shikoku)																							
Irareko	−	−	−	−	−	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	−	−	6
Yasuhara	−	−	−	−	1	−	1	−	−	−	1	−	2	−	1	−	2	−	−	−	−	−	8
Sengoku	−	−	1	−	−	−	1	−	1	−	1	−	2	−	1	−	2	−	−	−	−	−	9
Wada	−	−	−	−	1	1	1	−	1	−	1	−	1	−	1	−	2	−	−	−	−	1	9
Ohkawa	−	−	−	−	−	−	1	−	1	−	1	−	2	−	1	−	2	−	−	−	−	−	8
Kowase	−	−	−	−	1	1	1	−	1	−	1	−	2	−	1	−	2	−	−	−	−	1	9
Abetto	−	−	−	−	1	1	1	−	−	−	1	−	2	−	1	−	2	−	−	−	−	1	8
Gojyo	−	−	−	−	1	1	1	−	1	−	1	−	2	−	1	−	2	−	−	−	−	1	9
(Kyushu)																							
Hayadama	−	−	−	−	1	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	1	−	8
Nakakama	−	−	−	−	1	−	1	−	−	−	1	−	2	−	1	−	2	−	−	−	1	−	9
Kanazuchi	−	−	−	−	1	−	1	−	1	−	1	−	1	−	1	−	2	−	−	−	1	−	9
Okuzuru	−	−	−	−	1	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	1	−	7
Shimboso	−	−	−	−	1	−	1	−	1	−	1	−	2	−	1	−	2	−	−	−	1	−	10
Kuju-zairai	−	−	−	−	1	−	1	−	1	−	1	−	2	−	1	−	2	−	−	−	1	−	10
Oodecchi	−	−	−	−	1	1	1	−	1	−	1	−	2	−	1	−	2	−	−	−	1	1	10
Hachiretsuwase	−	−	−	−	−	−	1	−	−	−	1	−	1	−	1	−	2	−	−	−	1	−	7

representative type, and were observed for their chromosomal characteristics (Table 3). As the results, B chromosome was found only in the land-races from Mt. Fuji area, and not in other lines. In all the land-races, one or more knobs were found on the long arms of III, V, VI and VIII chromosomes. This was considered to be a remarkable characteristics of Japanese land-races. The number of knobs per cell ranged from 5 to 11. The increased knob number was in parallel to later maturity of land-races. Additional knobs were observed in each group as follows;

In fourteen out of twenty four lines, two knobs each on the long arm of the VI and VIII chromosome. In seven out of eight lines from Mt.Fuji, one knob each on the long arm of the II and VII chromosome. In three out of eight lines from Shikoku region, one knob each on the long arm of the II and IV chromosome. In seven out of eight lines from Kyushu region, one knob each in the II and X chromosome.

4) Postscript

Recently, the author had a chance to revisit the southwestern of Fukushima Prefecture. Having searched for the maize samples which were collected by the former collection trip, he found out only two samples out of thirty-one accessions. This fact indicates the genetic erosion which was brought about by modern transportation and positive activities of local agronomists for extension of modern hybrid corn cultivars for the past twenty years. The author would like to stress that urgent exploration of all kind of crops is necessary all over the world before valuable gene sources are lost.

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II – 2. Collection of Crop Genetic Resources in the Central Parts of Japan in 1987.

by

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CONTENTS

1) Objectives

Land races of crops which possess large genetic variations have still played important roles in stable food production in specific areas. They have adapted to natural environment of each area and have been cultivated there for a long time. Nowadays, however, they face the crisis of extinction due to the change of rural communities, the introduction of newly developed commercial varieties and standardization of production systems. They are much important as breeding varieties for improvement of new varieties. Therefore, it is an urgent subject to collect land races and to conserve them so as to decrease the genetic erosion. We carried out crop explorations in the central parts of Japan, Gunma, Niigata and Fukushima Prefectures where various local crop races are still expected to be cultivated in hilly places.

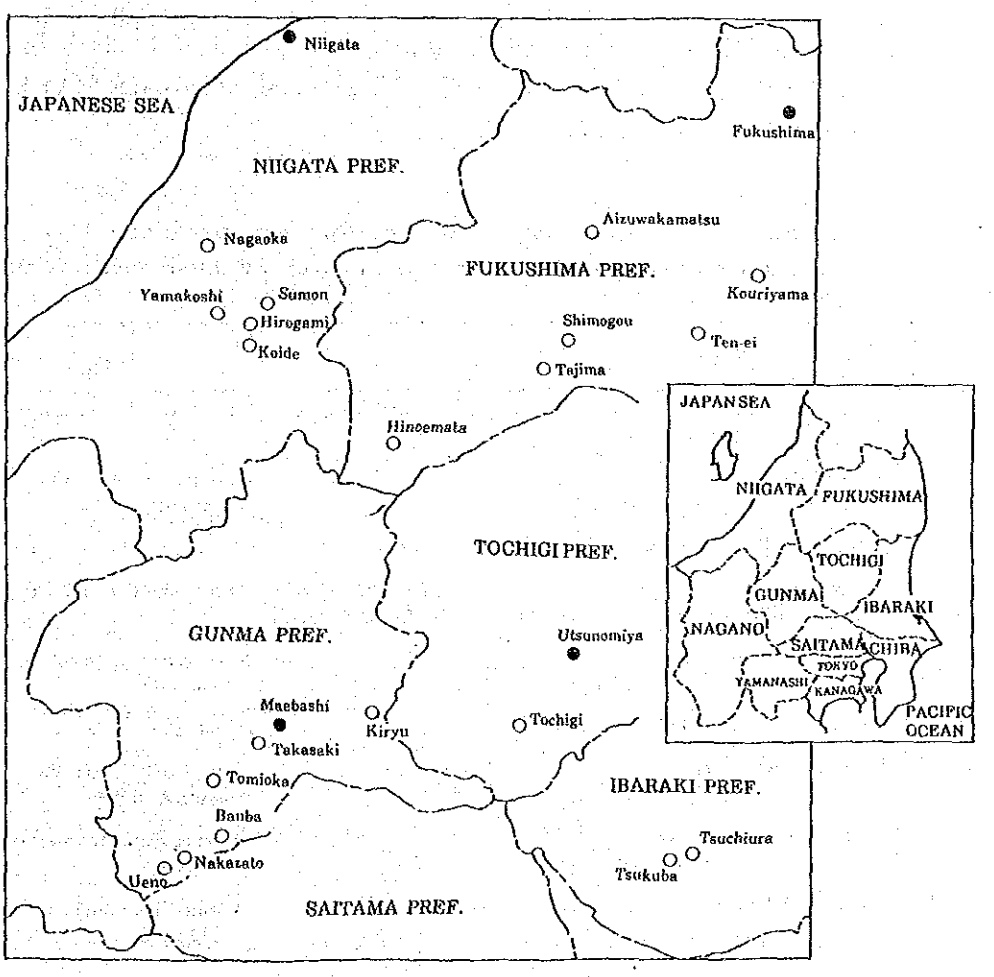


Fig.1 Collection sites in the central parts of Japan

2) Methods

Our research team have collected many kinds of local races including millets and grain legumes in rural areas of Ibaraki and Fukushima Prefectures since 1984. We could collect many local varieties of soybean (*Glycine max*), adzuki bean (*Vigna angularis*) and foxtail millet (*Setaria italica*) with a great success. In 1987, we extended the exploration sites to the adjacent areas, Gunma and Niigata Prefectures. The sites of the present exploration were the southwestern parts of Gunma, the central parts of Niigata and southwestern parts of Fukushima Prefectures (Fig. 1). In our exploration, we visited farmers' houses and fields, interviewed them about their crops, for example, local name, means of acquisition, cultivation practices, agricultural characteristics and usages, and received their crop seeds when they agreed.

Three explorations were carried out during the period of 12 days in October 20 to 22 in Gunma, in October 25 to 27 in Niigata and in November 4 to 6 in Fukushima Prefectures (Table 1).

Table 1 Itineraries of three explorations in the southwestern parts of Gunma, the central parts of Niigata and the southwestern parts of Fukushima Prefectures in 1987.

Date	Itinerary	Persons	Notes
Oct. 20	Tsukuba(departure, car) —Banba, Gunma (stay)	Nagamine, Katsuta, Nobori and Ilzuka	Move, 15 collections in Banba
21	Banba — Ueno —Nakazato (stay)	- do, -	46 collections of grain legumes and millets
22	Nakazato — Tsukuba (arrival)	- do, -	17 collections in nakazato
25	Tsukuba(departure, car) — Koide, Niigata — Nagaoka (stay)	Nakagahra, Yamashita, Chinushi, Sasaki and Yoshida	Move, 5 collections in Koide
26	Nagaoka — Yamakoshi — Sumon (stay)	- do, -	28 collections in Yamakoshi and Sumon
27	Sumon—Hirokane — Tsukuba (arrival)	- do, -	17 collections in Sumon
Nov. 4	Tsukuba(departure, car) —Ten-ei, Fukushima(stay)	Oka, Egawa and Itou	Move, 10 collections in the three places in Ten-ei
5	Ten-ei—Shimogou—Tajima —Hinoemata(stay)	- do, -	19 collections in two places in Tajima
6	Hinoemata—Tsukuba (arrival)	- do, -	14 collections of grain legumes and millets

Table 2. Crop species and collection number of local varieties in each prefecture.

Crops	Gunma	Niigata	Fukushima	Total
Rice	1	3	-	4
Grain legumes :				
Adzuki Bean	15	10	7	32
Common Bean	13	4	6	23
Soybean	15	22	14	51
Peanut	2	5	-	7
Cowpea	-	-	1	1
Glycine soja	-	2	-	2
Millets :				
Common millet	6	-	3	9
Sorghum	-	-	2	2
Maize	6	-	1	7
Foxtail millet	3	1	6	10
Barnyard millet	1	-	-	1
Buckwheat	3	1	1	5
Job's tear	1	1	-	2
Finger millet	1	-	-	1
Oil seed crops :				
Sesame	3	-	-	3
Perilla	7	-	1	8
Others :	1	1	1	3
Total	78	50	43	171

3) Results of collection

Through three explorations, we could collect a total of 171 varieties; 32 of adzuki bean, 23 of common bean (*Phaseolus vulgaris*), 51 of soybean, 9 of common millet (*Panicum miliaceum*), 7 of maize(*Zea mays*), 10 of foxtail millet, 8 of perilla (*Perilla frutescens*) and others (Table 2). It is noteworthy that lots of millets could be collected in the explorations in Gunma and Fukushima Prefectures. In the following sections, we described the characteristics of local crop varieties and their informations collected from farmers in each exploration site.

(1) Exploration in the southwestern parts of Gunma Prefecture

The southwestern parts of Gunma Prefecture including Banba Town,

Ueno and Nakazato Villages are located in the border area between Gunma and Saitama Prefectures and extend on a long stretch of hill along the Jinryu River (Fig. 1). Small villages are dotted in the places between mountains. The altitude ranges from 300 to 600 m. A black loam soil distributes in Ueno V. and the soil in other areas shows a gravel texture with high water drainage. All field crops are cultivated in the narrow terrace fields on slopes of hills. Sericulture had the most important role in agricultural production in the areas and many kinds of field crops have been cultivated exclusively for home consumption for a long time.

Total number of collections was 78; 15 of soybean, 30 of grain legumes, 21 of millets, 6 of maize and others (Table 1). Large number of millets, foxtail millet, barnyard millet(*Echinochloa crus-galli*), common millet and finger millet (*Eleusine coracana*), and maize could be collected in the areas (Table 3). It is much interesting that millets, regarded as "abandoned" crop in Japan, are still maintained for home consumption of farmers.

A farmer in Ueno V. keeps and cultivates common millet and foxtail millet as health food. Finger millet is called "Koubou-bie" which was named after a famous monk. Its flour is used for making dumpling as made from buckwheat (*Fagopyrum esculentum*). Common millet is called "Kimi" or "Kibi". Black pericarp type of common millet is more popular than white type in the village. Foxtail and common millets are also preserved in other villages. Local maize variety known by the name of "koushu-morokoshi" is a flint type with plant height of 200 cm.

Every farmers cultivate several varieties of soybean depending on the cooking and processing ways as follows; "Hitashi-mame" with green seed color for boiled bean seasoning with salt, "Kuro-mame" with black seed color for boiled bean, "Kinako-mame" for making flour and "Miso-mame" for bean paste. Each soybean variety has large variations in the seed shape and size. A variety "Aobata" collected in Nakazato V. is well fit for soybean paste and curd. But the variety had disappeared in other areas.

A local variety of adzuki bean with red seed testa, "Dainagon", distributes widely in all the areas. Our exploration indicated that "Dainagon" in the areas includes different varieties because they show the variations in size and brightness of the seeds, pod color and maturity. We could collect other local varieties with a white and red seed testa. It is said that white colored type can be cultivated even in the unsunny slopes and be easily cooked in short time. They

have been cultivated in small fields for self-consumption since white colored type is unsuitable for marketing. Common bean (*Phaseolus vulgaris*) also show large variations in size, shape and color of seeds.

Cultivation of perilla is more popular as a oil seed crop than that of sesame and it is called "Egoma" or "Ekusa" in the areas. There are two types concerning pericarps, grayish white and black. The grains are used as one kind of spice for dishes and soups after parching and grinding.

The agricultural characteristics in the southwestern parts of Gunma Prefecture are as follows: a) small scale cultivation of various field crops on the slopes of hills, b) production mainly for home consumption and c) large genetic diversity of local crop races, especially of grain legumes and millets.

(2) Exploration in the central parts of Niigata Prefecture

The exploration was conducted in the valley of the Shinano River and its tributary, the Echigo River (Yamakoshi V., Sumon V., Hirogami V. and Koide T.)(Fig. 1). The areas are hilly places with altitude from 180 to 420 m and is famous for heavy snowfall.

We could collect various seeds of local varieties and their informations while observing plants and seeds in the fields and yards of farmers, since exploration period corresponded to the harvesting time of summer crops. Major crop is rice in the areas and grain legumes and millets have been also cultivated for home consumption. Total number of collections was 50 in the areas (Table 1). Major collection was grain legumes; 22 of soybean, 10 of adzuki bean, 5 of peanut, 4 of common bean, 2 of *Glycine soja* (wild relatives of soybean)(Table 3).

Two local varieties of soybean are widely distributed in the areas. They are called "Hitorimusume" having green seed color and "Ginnan-mame" having yellow seed color. Black soybean shows large variations in size, brightness and shape of seeds. The seeds are used as boiled bean with sugar in the New Year's Day. Adzuki bean is also one of popular grain legumes. There are variations in maturity and pod color (black or white). Adzuki bean seeds are boiled with glutinous rice for making "Sekihan"(red colored rice) and are crushed into "An"(paste) after boiling. In Sumon V., local adzuki variety called "Usugoromo" have been maintained more than 60 years for home consumption and the seed skin color is gray with black mottles.

Table 3 Samples of local crop varieties collected during the explorations in the central parts of Japan.

Coll. No.	Crop name	Genus & Species	Local name	Date	Locality (Altitude, m)	Notes
870051	Common bean	*Phaseolus vulgaris*	Shiro-ingen	Oct. 20	Banba, Tano,Gunma (300)	for bean paste,white round seed,viny growth
870052	Adzuki bean	*Vigna angularis*	Dainagon			for bean paste ("An"), red seed habit
870054	Soybean	*Glycine max*	Hitashimame			for boiled beam ("Hitashi-mame"), green seed
870061	Maize	*Zea mays*	Toumorokoshi		(530)	flint type, cultivated since 50 years ago
870064	Common bean	*Phaseolus vulgaris*	Sujinashi			used young pod as vegetable or for boiled bean
870071	Perilla	*Perilla frutescens*	Ekusa		(350)	for dressing, black pericarp
870073	Adzuki bean	*Vigna angularis*	Shitotogashira		Ueno, Tano, Gunma (420)	for "An", white with red patterned seed color
870074	Foxtail millet	*Setaria italica*	Awa			for cake ("Mochi")
870076	Finger millet	*Eleusine coracana*	Kouboubie	Oct. 21		make dumpling ("Dango") from flour
870077	Barnyard millet	*Echinochloa crus-galli*	Hie			bird feed
870078	Common millet	*Panicum miliaceum*	kimi			for cake ("Mochi")
870086	Sesame	*Sesamum indicum*	Kurogoma			for dressing
870097	Soybean	*Glycine max*	Kuromame		Banba, tano,Gunma (310)	for boiled bean
870101	Job's tear	*Coix lacryma-jobi*	Hatomugi			for Coix tea
870105	Common millet	*Panicum miliaceum*	Kurogimi		Nakasato,Tano,Gunma(570)	for cake ("Mochi"), black pericarp
870122	Adzuki bean	*Vigna angularis*	Shiroazuki	Oct. 22	(680)	for sweet jelly ("Youkan"), white seed
870220	Soybean	*Glycine max*	Aobata		(360)	for soybean paste ("Miso")
870129		*Glycine soja*	Tsuru-mame	Oct. 25	Nagaoka,Koshi,Niigata (20)	wild soybean, markedly viny growth habit
870133	Soybean	*Glycine max*	Hitorimusume	Oct. 26	Yamakoshi,Koshi,Niigata(340)	green seed, grey pod
870135	Rice	*Oryza sativa*	Umesaburo			purple hull
870153	Peanut	*Arachis hypogaea*	Jimame		Sumon,Kitaconuma,Niigata(240)	small red seed, thin seed testa, old variety
870158	Adzuki bean	*Vigna angularis*	Usugoromo	Oct. 27	(230)	grey seed with black mottles
870176	Sorghum	*Sorghum bicolor*	Morokoshi	Nov. 4	Ten-ei,Iwase,Fukushima (600)	for dumpling mixed with glutinous rice
870183	Common bean	*Phaseolus vulgaris*	Suzumenotamago			erect growth type
870195	Runner bean	*Phaseolus coccineus*	Hanayomesasage	Nov. 5	Shimogou,Minamiaizu, Fukushima	for boiled bean
870201	Cowpea	*Vigna unguiculata*	Kuroazuki		(730)	for boiled bean
870209	Foxtail millet	*Setaria italica*	Kuromochi	Nov. 6	Hinoemata,Minamiaizu, Fukushima	glutinous type
870210	Soybean	*Glycine max*	Shinamame		(1030)	for soybean curd ("Tofu")
870215	Adzuki bean	*Vigna angularis*	Kuroazuki			for bean paste ("An"), black mottled color seed

Three local rice varieties were collected in the areas. They are called by the same name of "Kuromochi". Farmers told us their strong ability of cold resistance. Their straw can be available for rope. Farmers use the name of "Umesaburo" to the same variety in some places of Yamakoshi V..

Rice cultivation have well developed along the both sides of river in the area (Table 1). On the other hand, millets is cultivated sporadically in small size of fields. Local varieties of grain legumes have been maintained by farmers for a long time. Further exploration should be conducted for the collection of local grain legumes in the areas including the hilly places in the south part of Niigata Prefecture.

(3) Exploration in the southwestern parts of Fukushima Prefecture

The exploration was conducted in the long stretch of hilly and mountainous areas from Ten-ei V. via Shimogou T., Tajima T. to Hinoemata V. which is located in the border area between Fukushima and Niigata Prefectures. Field crop and rice cultivation have developed on the slopes and flat places in the areas excluding Hinoemata V.. Hinoemata V. with the altitude of 1,100m is a depopulated area and its family number and population are only 280 and 600, respectively. Only field crops such as buckwheat, some kind of millets and grain legumes are cultivated, but the village has no history of rice cultivation. Sericulture was major industry in the past time in all villages and towns in this areas.

Total number of collections was 43 varieties of local crops through the exploration; 14 of soybean, 7 of adzuki bean, 6 of common bean, 6 of foxtail millet, 3 of common millet, 2 of sorghum and 5 of others (Table 3).

Various local varieties of soybean are widely cultivated; "Kuro-mame", "Hitashi-mame", "Nattou-mame" and "Kinako-mame". These varieties are used for boiled bean, "Natto" (fermented bean), "Tofu" (bean curd) and "Kinako" (flour), respectively. Local varieties of adzuki bean have disappeared rapidly at present due to their low commercial value. However, we could collect three local varieties of black colored adzuki bean. They are available for "An" (bean paste). Common bean shows wide variations in size, shape and skin color of seeds, Moreover, large differences in cultivation methods, growth pattern, plant type and usage were also recognized in the areas.

Foxtail millet, common millet and sorghum have just reappeared in well-drained paddy fields as the substitution of rice under the control of rice production. They are cultivated in the small size of paddy fields and their glutinous endosperm seeds are cooked together with glutinous rice. We interviewed an old woman who was threshing grains of foxtail millet in Shimogou T., and could obtain the information that some millets could be planted as the first crops at the beginning of cultivation in the slopes of hilly places, since they showed high cold resistance and good growth even on infertile soil conditions. Only glutinous types of sorghum, foxtail and common millets are distributed among friends and relatives and cultivated in small fields. The millets will disappear sooner or later with the decrease of the old generations in the areas.

4) Distribution of collection

All grain legumes and millets collected from three prefectures will be planted in the experimental fields of the National Institute of Agrobiological Resources (NIAR) and some of their growth characteristics will be evaluated. Seeds will be transferred to the control of Central Gene Bank of NIAR after multiplication. We have a plan to distribute other collections according to requests.

5) Impression

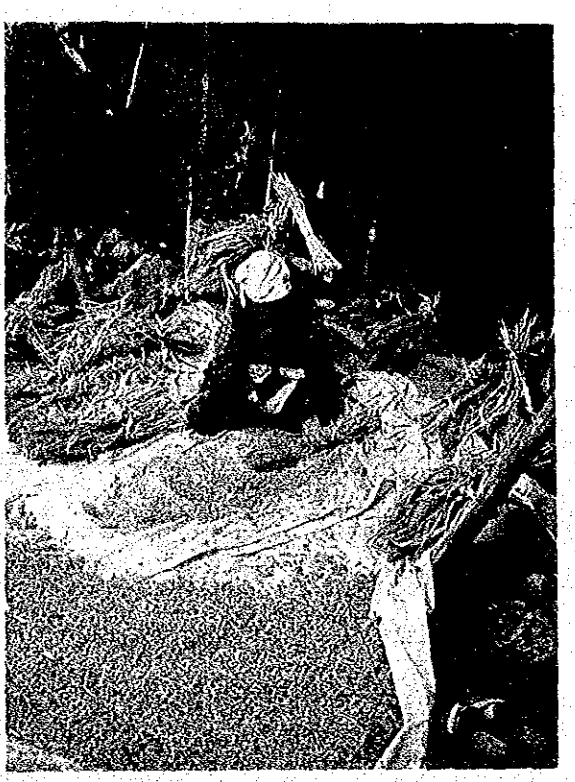
There was not always much time to collect local seeds and their information in our exploration. Even in our short visit to farmers, we could have good experiences to see old men and women who were willing to talk about their customs, experiences and circumstances with respect to agricultural production in the present and past times. Also we knew through the interview that local varieties has been maintained by women's long efforts to enjoy a variety of food. Through the talking with farmers, we explained the importance of local varieties as breeding materials in crop improvement.

Our explorations made clear that various kinds of local crop varieties, especially of grain legumes and millets, remain fairly in the three regions of Gunma, Niigata and Fukushima Prefectures. However, local varieties of crops are supposed to disappear in the near future. The following factors cause the

marked decrease of local crop varieties in rural areas; a) change of eating habits, b) introduction of newly developed commercial varieties and c) maintenance of local varieties only by old generations. The marked decrease of them takes place in various parts of Japan in recent years. The intensive exploration should be planed for wide areas to cope with the crises of extinction of local varieties.

6) Acknowledgment

We are grateful to many farmers for kindness and nice cooperation in three regions of Gunma, Niigata and Fukushima Prefectures.



Threshing of foxtail millet in a farmhouse

Sampling of pulses in backyard of a farmhouse

II – 3. Collection of Local Germplasm of Cruciferous Vegetables and Others in the Kinki Region in 1986

by

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CONTENTS

1) Objectives

As extinction of local germplasm is recently aggravated by increasing adoption of hybrid varieties and by changes in socio-economic situation, collection and preservation of local germplasm is urgently necessary. Under a budgetary support of the Ministry of Agriculture and Fisheries, the title of which was collection of plant germplasm in Japan for the fiscal year of 1986, an investigation tour was organized to collect local varieties of Cruciferous vegetables in the Kinki region.

2) Methods of investigation and collection

(1) Determination of timing for the collection

Season for an investigation is one of the important factors for the collection to be successful. Usually in late October, when cruciferous vegetables are at vegetative stage and rice is harvested, searching for short-statured cruciferous vegetables in scattered farm is easy as no other crop hinder sight. Crops can be observed *in situ*, and it is easy to see whether the seed source is of domestic production or commercial. In that period farmers are still working in farms, from whom we can hear about local germplasm. Seed can be obtained from farmers, who may have stored some seed for next year's seed production or may have some residual from seeding in early September. If there is no seed left, then, we may ask some plants for producing seed or ask them to send us some seed in next seed production season.

For these reasons a period from 21st to 25th of October in 1986 was chosen for the collection tour.

(2) Selection of sites for the investigation

In the planning of the investigation route, some literatures were surveyed about domestic local vegetable varieties. There are many literatures which report local cultivars and food customs in the Kyoto and Shiga region. Some references are listed at the end of this report.

On the basis of the references, the following route was decided to visit production sites which are mostly in Shiga or Kyoto Prefectures:

National Research Institute of Vegetables, Ornamental Plants and Tea (NIVOT) - Shiga Prefectural Agriculture Experiment Station (Azuchi Town) - Moriyama City - Hikone City - Yogo Town - Imazu Town and Makino Town - Maizuru City - Fukuchiyama City - Kyoto Prefectural Research Institute of Agriculture (at Kameoka City) - Kyoto City - NIVOT.

These sites are not far from NIVOT. The main reasons why vegetable germplasm is abundant in the selected sites are explained herewith (Fig.1).

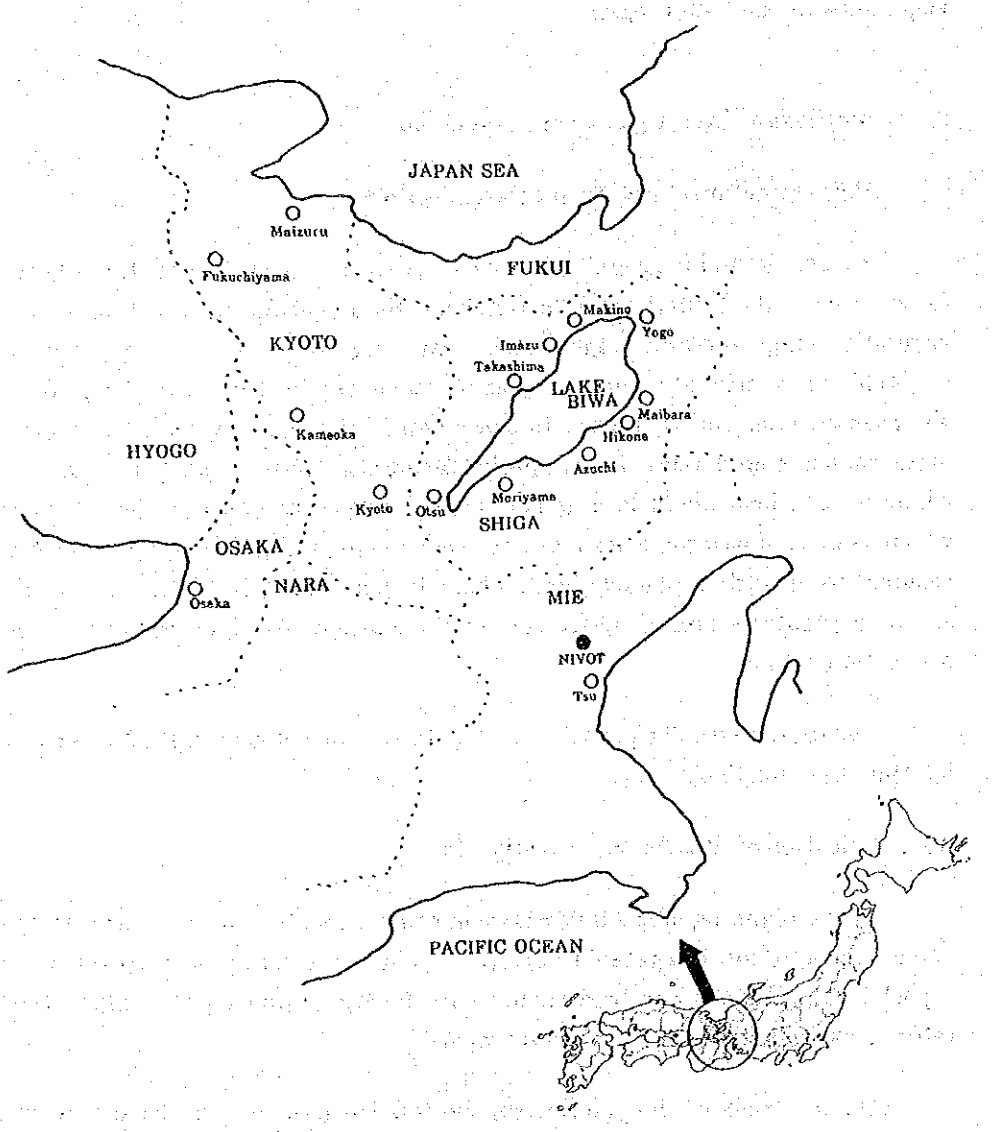

Fig. 1 Sites of collection

Kyoto had been the capital of Japan for about 1,200 years. Throughout the period, many vegetables were introduced from every regions of Japan and even from foreign countries, and had been cultivated for long period. There are many shrines and temples, where various kinds of fresh and high-quality vegetables are demanded all year round. Being far from sea shore, Kyoto is not in a good place to get fresh fishes. Naturally, the strong demand for vegetables encouraged intensive vegetable production. The climate is suitable to growth of vegetables and the soil is fertile with good drainage. Under such circumstances, the level of farmers' technique is adequately developed so that vegetables are produced all year round. By the virtue of the favorable climate and the farmers' effort, today's advanced vegetable production has been established in the region. Various kinds of vegetables are supplied in a close relation with the culture and daily customs of the people in Kyoto. Far from being a big industrial city, Kyoto has not been developed so fast as Tokyo and Osaka has, and still keeps many areas for vegetable production in its outskirts.

Shiga Prefecture is in the neighborhood of Kyoto and have prosperous times under the cultural influence of Kyoto. Its cultural tradition still remains, as its industrial development has not been fast. With Lake Biwa, one of the biggest in Japan, in its central part, this prefecture is snowy in winter so that the people have to grow and preserve vegetables for winter in the form of salt pickle or fresh one. Such situation raised farming techniques for vegetable production as well as for seed production.

(3) Cooperation

Cooperative approach is decisively important for investigation of local germplasm. The present investigation was conducted in the cooperation with the following institutions:
Shiga Prefectural Agriculture Experiment Station, Kyoto Prefectural Research Institute of Agriculture and Kyoto Otokuni Agriculture Extension Service Center, and some other agriculture research stations and many seeds companies in the Kinki region, to which we asked their collection via mail.

3) Results of the investigation at each site

(1) Moriyama City

"Yashima", a traditional turnip in this town was found in small gardens, where some other local turnips, such as "Hinona", "Yurugi aka-maru" were also planted. Farmers grow these crops for home consumption during winter. "Hinona", "Yurugi aka-maru" and "Yashima" each occupies 50, 10-20 and 10 percent of the total turnip area, respectively. Seed of these varieties is sold at stores and no farmer produce it by themselves. We were able to purchase the seed of "Yashima" and "Yurugi aka-maru" at the Endo Seeds Co. which was in the vicinity. A lady owner of the store deplored that "Yashima" turnip was fading out in the decrease of the amount of sold seed.

"Yashima" is characterized by semi-erect plant type with purplish green leaf, the shape of which resembles that of "Hinona". Its root is round with purple top.

"Yurugi aka-maru", a traditional variety are characterized by semi-erect plant type with green and smooth-edged leaf, and red round root.

(2) Hikone City

"Hikone-kabu", which is also called "Koizumi-kabu" or "Irie-kabu", is a traditional turnip. Along a farming zone on sandy loam soils in the east shore of Lake Biwa, there are many small gardens of vegetables for home consumption in winter. According to farmers' information, there are local turnips, which have been reproduced by farmers' seed, along an old road behind of the main national road at Asazuma, Maibara Town. In this area some local turnips produced by farmers' seed were collected.

The collections are classified into three varieties:

a. "Beni-kabura": Cultivated by Mr. MIZOGUCHI continuously by domestically reproduced seed at Asazuma, Maibara Town, Sakata Gun, Shiga Prefecture. This variety is characterized by somewhat small number of green, smooth-edged leaves with red midrib and deep-edged leaflets at its base, and by wholly red, semi-round root with pinkish white tissue. Its texture is more tender and more clearly red than those commercially produced. Farmers consume the turnip as lightly or heavily salted pickle. For the seed production, their traditional method is to prevent inbreeding depression by exchanging mother plants among farmers.

b. "Irie-kabu": Maintained continuously by Mr. KITAMURA at Asazuma-chikuma, Maibara Town, Sakata Gun, Siga Prefecture. This variety is specially cultivated in sandy farms along the east shore of Lake Biwa, and characterized by its root longer than "Koizumi-kabu"s, and swollen and round root tip. Its root skin is dark scarlet with white inner tissue. Its tissue is fine textured and hard. Its leaf is slender and long, slightly notched with round tip and dark scarlet petiole. This variety is seeded in early Autumn and harvested late in the year. Salt-pickled root using rice bran has inner tissue stained dark scarlet and a crispy tissue of a special taste and sweetness, which can not be made from any commercial variety. Its leaf tastes well. Washing the root is not easy as the shape is irregular and of rat-body type, however, this variety is officially recommended as a unique local product, and is still cultivated and shipped, though small in quantity. We collected some seed which farmers left at sowing time.

c. "Akamaru kabu": Being cultivated in sandy soils of the lake side in Chikuma, like as another variety, "Irie kabu". We obtained some seed from Mr. KITAMURA who maintained the seed continuously. In this area, farmers keep a traditional method of seed production, i.e., exchanging mother plants mutually to prevent inbreeding depression. However, this method is not being succeeded to younger farmers who have jobs in companies and showing little interest in farming. The members participating to this seed production system decreased to only a few of aged farmers.

(3) Yogo Town

"Yama-kabu" has been cultivated at farms made arable by slash-and-burn method from time immemorial. The field opened by slash-and-burn method has been shifted closer to housing areas from much isolated places. Concurrently, the root shape has varied to round type from traditional long one. The farmers usually cut grass in early August, burn it two weeks later practicing seeding and plowing at a same time, and harvest the crops late in the year. The "Yama-kabu" is characterized by reddish green hairy smooth leaf with shallow edge and red petiole. Its plant is somewhat erect with red and round root of middle size. Its root tissue is white but turning to red after processed in pickle. As heavy manuring weaken the green and red color of the leaf and the red root color, this variety is grown without any chemical fertilizer. After harvesting, the root is dried for about a month and pickled with salt. Long-storaged pickle is served from April to May or to July. The pickle is initially brown but turn to clear red

by adding a few drops of vinegar just one or one and a half hour before eating. When pickle become acid, then it can be oil-fried after washing and bleaching the root in water. The fried one also tastes well.

When we visited the site, the turnips were cultivated in a coarse gravel-sandy soil. They planted about twenty stocks for mother plants in a seed production garden in a slope, after having their roots cut half at bottom and the section dusted with ash. Some seed of this variety was collected from Mr. TANIGUCHI and Mrs. KAWAGUCHI who maintained the seed continuously.

(4) Makino Town and Imazu Town

"Hiruguchi-kabu": A traditional variety at Hiruguchi, Makino Town, Takashima Gun, Shiga Prefecture. Having heard from local people and in the town office, we noticed that this variety was not cultivated any more. According to a farmer who once cultivated this variety, they used to seed it at a planting density of a plant to every 30cm in rows separated by 60cm in late September just after harvesting rice. Heavy manuring was good for vigorous initial growth. They used to harvest it in late November to early December. The root tissue was red and tasted well. It is said that "Hikone-kabu" was introduced here and became indigenous.

"Akagawa-aka-kabu" : A traditional type at Sumikawa of Imazu Town, Takashima Gun, Shiga Prefecture. Although no information was available in literatures, we found this variety was planted at a corner of rice farm in Sumikawa, where a few farmers like Mr. MATSUMOTO maintained this variety using seed of domestic reproduction. The crop is seeded in Autumn and harvested late in the year, and processed into pickle with light, middle or heavy salt. Color of pickle with heavy salt is not attractive.

This variety is characterized by semi-erect plant type and by hair-less, spoon-shaped leaf with long red petiole. Its root is red and round with slightly pink top. The root is processed to pickle salted overnight or to sliced pickle by the name of Senmai-zuke with vinegar, soy sauce and sugar. The processed one tastes better if produced under moderate manuring, but bitter if produced under heavy manuring.

As no remaining seed was available, we asked the farmers to send it after next seed production.

(5) Maizuru City

"Maizuru-kabu", "Sabaga-kabu" and "Sabaga-daikon" are indigenous to this area.

"Maizuru-kabu": Described in literatures as being produced at Kita, Maizuru City, but was not found any more. It was only assumed that it had been grown in Ookimi, near Kita. When we visited Ookimi Village, a old woman said that she had maintained it until the year before our visit but she had burned the seed stocks, having found some contamination with other varieties of *Brassica campestris*. She used to be proud of maintaining the traditional variety and to enjoy her life by sharing the seed to friends and relatives. She deeply regretted the mistake in seed production.

This variety was characterized by red, tender root which tastes well with a good flavor. In response to our question, she told that youngmen were willing to take jobs in city areas rather than working in farms, and unable to produce the seed. Seed production is on the shoulder of aged people in recent years. The member participating to seed production decreased to only three some years ago, and finally the lady remained. The town is close to the city of Maizuru and vegetables are still produced by aged people for marketing using commercial seed.

"Sabaga-kabu" and "Sabaga daikon": These two cultivars are specifically grown at Sabaga, Maizuru City. According to our hearing from Mr. ISHIHARA, the two cultivars had been in this site from time immemorial, but disappeared completely about twenty years ago. "Sabaga-kabu" was a turnip with heart-shaped, green-top root, and used to be served in the form of water boiled, soup or lightly salted pickle, which was soft-textured and tasted very well. "Sabaga-daikon" had been cultivated mostly for shipping to Kyoto in straw packages for charcoal, but lost its share at the market having been replaced by daikon (radish) from Wakayama City, which was less spoiled during transportation.

Two major reasons for disappearance of local varieties are indicated: Firstly, whole sale markets prefer vegetables produced from commercial seed to those indigenous. Secondly, as many kinds of vegetable are grown in this area, purity of local seed tends to be degraded through outcrossing with different varieties.

"Kujo-negi" (leaf onion): As we were informed that Mr. ISHIHARA had been producing the seed of "Kujo-negi" for a long time, we visited him and obtained some seed of the variety.

The variety is seeded in September, and transplanted in May-June of the next year at a ratio of four plants a spot. Then, the plants are dug out and dried under a shade, and transplanted again with a ratio of 2-3 plants at a spot in late August after the upper leaves are cut off at 15-20cm from the base. The plants is harvested from October to April.

In this area vegetables are produced mostly by aged people, as young people are working at companies in city.

"Hama-daikon": On the basis of information that there is a number of wild radish growing at sites close to sea shore of Mihama, Maizuru City, we found there many stocks of the wild radish, Tsuruna (*Tetragonia tetragonoides*), and hamabofu (*Glehnia littoralis*) on the ground of a shrine. The plant of the wild radish is bush type with green, deeply notched leaf and long white roots. Also, at an edge of a road near the shrine, we found many plants of radish which may have escaped from cultivation, and collected some plants.

(6) Fukuchiyama City

Although there is no literature about local vegetables in this areas, we expected to find some as the site is on a major route to Kyoto from Maizuru City. In many small gardens, we found cultivated turnips, Chinese cabbages, Japanese radish and so on, however, these were identified as commercial varieties by their appearance and uniformity. No local ones were found.

We went to mountainous areas, where there were similar gardens, and we could not get any information. We met only a farmer who had produced burdock seed. In this case he reproduced it 2-3 generations after he purchased a commercial seed source. In this area once famous for silk-worm production, production of vegetable did not seem to be developed. The farming is today continued by aged people.

(7) Kyoto City

Kyoto Prefectural Research Institute of Agriculture at Kameoka City has initiated a project of collection and propagation of fifteen traditional vegetables.

We visited an experiment farm at the institute, to which 13 cruciferous varieties are planted for maintaining or preservation.

The varieties were as follows:

"Momoyama-daikon", "Kuki-daikon", "Sabaga-daikon", three lines of "Aomi-daikon", "Karami-daikon", "Nezumi-daikon", two lines of "Maizuru-kabu", "Ohuchi-kabu", "Sugukina", "Matsugasaki-ukina". The institute has forwarded the seed of "Momoyama-daikon", "Kuki-daikon", "Sabaga-daikon" to the National Institute of Agricultural Sciences (presently the National Institute of Agrobiological Resources) in 1981. With regards to "Aomi-daikon", however, the seed supply to other institutions is declined for protecting the unique production area and the producers. Therefore, we decided it better to suspended our seed request, until any measures are taken to solve this problem. This issue may be a problem to be investigated in future.

We took trips to areas of traditional vegetable cultivars in the north and east of Kyoto City under the guidance of staffs of the Kyoto Prefectural Research Institute of Agriculture, the Otokuni Agriculture Extension Service Center of Kyoto City."Karami-daikon": Found to be grown in a field of Mr. SHIMAMOTO at Takagamine, North ward of the city. This variety which is served as spices for buckwheat or wheat noodles is cultivated in a contract with noodle shops. And the growers are not willing to share the seed.

"Sugukina": Found to be grown in a field of Mr. MIZOKAWA at Kamigamo, North ward of the city. His seed production technique is for preventing inbreeding depression by mixing 90 percent of mother plants and 10 percent of pollen donors in a seed production plot. In this system, the mother plants have to be of good taste and quality, while the pollen donors be vigorous even if they are not of best quality.

In this area "Sugukina" is cultivated by 160 growers in a total of 40 hectares. They have 34 young successors of the farming. One time, they had a problem in introducing hybrid varieties, which were not accepted to markets due to its soft texture and taste.

"Kuki-daikon": Found in a field of Mr. IWASAKI at Matsugasaki, Sakyo Ward of the city. It has crispy texture and late spongy character, and cultivated in limited areas.

"Horikawa-burdock": Found in a field of Mr. OHTANI at Ichijoji, Sakyo Ward of the city. This variety is commercially reproduced, but the cultivation technique is of special and traditional. The taste of the products is excellent and served in special dishes.

"Shogoin-daikon": Found in a field of Mr. NAKAJIMA, at Shugakuin Ward of the city. Today, a commercial hybrid variety is grown and replacing local ones which are maintained by farmers except those late varieties.

In the collection tours we were deeply impressed by the fact that the cultivation of local varieties were still continued in the city area, even being surrounded by tall buildings and isolated from other varieties which are potentially sources for outcrossing. The cultivation is sustained by consumers' traditional taste as well as by special traditional techniques for cultivation and seed production.

Next, we surveyed local varieties in Hushimi Ward of the city. We visited Mr. TAKAHASHI at Horiba, Nakajima Town near the area producing "Kujo-negi"(leaf onion), who was cultivating varieties of *Brassica campestris*, such as, "Mibuna", "Hatakena", "Wakana", "Ohsakina" and "Mizuna", using his own seed source for many generations. We obtained some seed from his source and heard of his cultivation method.

The efforts to collect local varieties is being continued in cooperation with Prefectural Agriculture Experiment Stations and private seed companies in Kinki region.

We acknowledge with thanks the assistance extended by Dr. MORI, Shiga Agricultural Experiment Station, Dr. KISHIMOTO and Dr. NISHINO, Kyoto Prefectural Research Institute of Agriculture, Mr. KITAZAWA and Mr. SATO of the Kyoto Otokuni Agriculture Extension Service Center.

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"Yama-kabu" turnip is cultivated by slash-and-burn method at a hillside farm

Samples of "Yama-kabu" turnip

III. Report from Exploration and Collection of Native Germplasm in Nepal

A Preliminary Report on Geographical Distribution and Characteristics of Cultivated Buckwheats, Genus *Fagopyrum* in Nepal

by Akio UJIIIARA
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CONTENTS

1) IBPGR mission for collecting crop germplasm in Nepal

The Kingdom of Nepal is a small land-locked country lying between the latitude 26°20'N and the longitude 80°15'E, and spanning a distance of about 800km from east to west between Tibet and India. On the basis of altitude, the land of Nepal is classified into four regions as follows:

The Himalayan regions from the altitudes of 3,600m to 8,800m,
The mountainous region from the altitudes of 600m to 3,600m,
Inner Terai region and
Terai region in the altitudes below 600m.

Topographically, this country includes tropical areas in the plains of Indian Subcontinent, temperate hills, valleys and alpine zones of the Himalayas with a variety of climates. Nepal has a total cultivated area of about 39,300km^2 which accounts for nearly 28% of the total area. With more than 90% of the population being engaged in farming, it is a typical agricultural country like India, Pakistan and Bangladesh in the Indian Subcontinent.

Since ancient times, many kinds of crops have been cultivated, and adapted to the extremely variable climates in Nepal and differentiated into a large number of local varieties. On the other hand, the people of the country is a complex of Indo-Aryan and Tibet-Burman races. The religions, cultures and social customs of the peoples have developed different kinds of crops and ethnic ways of food processing. Thus, the differentiation of the crops are affected not only by its natural conditions but also by such ethnic factors.

As Nepalese agriculture has been developed rapidly in recent years, introduction of improved varieties of main crops, such as paddy, maize, wheat and soybeans has eroded the genetic diversity. The genetic erosion is still aggravated.

In apprehension of the situation, the IBPGR has organized a series of collection missions to cover a variety of crops in an international cooperation with China, Japan, Nepal and the United States. The mission headed by Prof. M. IIZUKA visited Nepal in 1984-1985, and collected a large number of cultivated plants and their wild relatives from fields, farms and farmers' storages in many remote villages in the country. In each year, the mission was divided into two or three teams each of which was led by a crop specialist. As a part of more than

4,000 samples of various crops the mission has collected about 150 samples of buckwheat. The areas covered by the mission is shown in Fig.1.

2) Description of the cultivated buckwheat

Buckwheat is processed as grain. Its seed looks like grain of wheat, rye, oat, or millets, each of which belongs to the family of Gramineae. It is often regarded as a kind of cereals, but belongs to the genus *Fagopyrum* in Polygonaceae family.

Two cultivated species, namely, *Fagopyrum esculentum* MOENCH (Common buckwheat) and *F. tataricum* GAERTEN (Tartary buckwheat) are included in the genus together with a wild or perennial species *F. cymosum* MEISEN.

Varieties of common buckwheat are classified into two types according to grain color, viz., the Japanese type with brown to black color and the silver-hull type with grayish silver color. The Japanese type is cultivated mainly in Japan, China, Soviet Union, Canada, United States and in such Himalayan countries as Nepal, Bhutan and northern India. While, the silver-hull type is in France, Yugoslavia, Poland, and in other European countries.

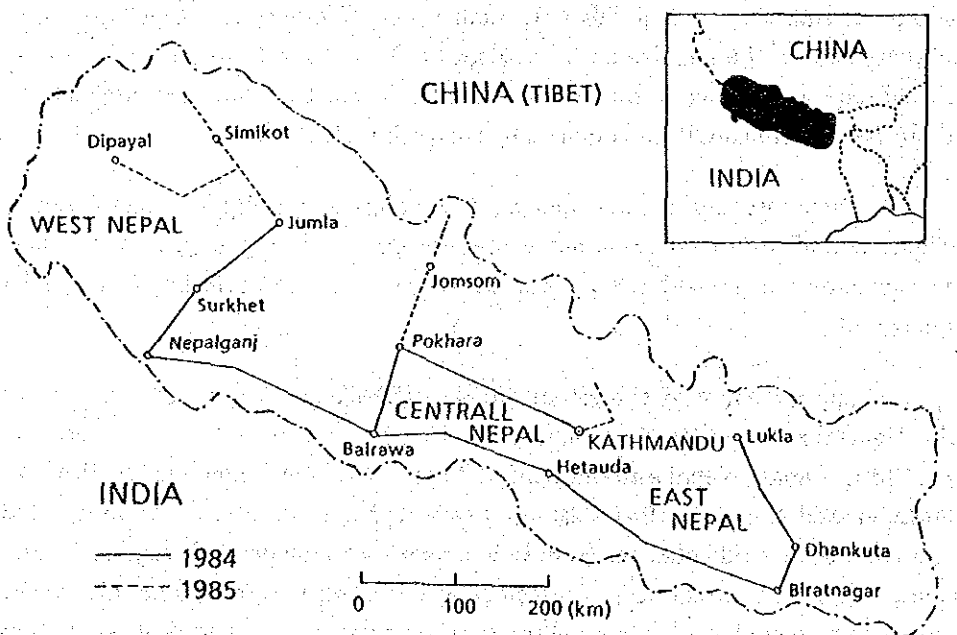


Fig. 1 Route map of IBPGR collecting mission in Nepal, 1984-1985

The common buckwheat is annual type with a height of 0.5-1.5m and several branches on main stems, which is grooved, angular and smooth with exception at nodes. Its leaf is triangular and heart-shaped with a length of 5-10 cm. Its flower consists of fine partite perianths being white, pink or red. The inflorescence consists of axillary or terminal racemes with clustered and indeterminate flowering habit. The flowers are dimorphic, viz., one type has flowers with stamen shorter than style (pin), the other has stamen longer than the style (thrum). The common buckwheat is naturally cross-pollinated, and self-sterile. The seed is inside of pericarp of hull, and has pale brown testa, being triangular like the fruit of beech tree.

The Tartary buckwheat is often called Indian wheat or rye-buckwheat as the seed shape is similar to that of wheat and rye. It is distinguished from the common buckwheat by their flower and flower type, that is, the flower bone in axillary racemes is small with pale green sepals. But its flower type is the same as that of common buckwheat. As this species is self-fertile, its grain yield is frequently as high as two times that of common buckwheat.

3) Geographical distribution of the cultivated buckwheat in Nepal

The precise statistics of the areas planted to common buckwheat is not available in Nepal. Generally speaking, a tendency is found that the cultivation of common buckwheat increases as altitude becomes higher, especially in hilly areas above 1,500m. In the areas above 3,000m, it is cultivated as an important food crop like naked barley and potato, and a staple food to the people. Fig.2 shows vertical distribution of the two species in the surveyed areas. Common buckwheat in western areas is widely cultivated from the lower Terai Plain in altitudes of about 300m above sea level up to mountainous regions in altitudes of about 3,000m. Contrary to the western regions, cultivation in the east is limited in an altitude of about 1,000m.

On the other hand, Tartary buckwheat is cultivated in hilly areas above the altitude of about 1,000m. Especially, in the central Nepal it is cultivated up to the height of 3,800m in the vicinity of Tibetan border.

As a whole, the common buckwheat is widely cultivated from low altitudes of subtropical zone to high altitudes of cool zones. Though Tartary buckwheat yields more than common buckwheat as a self-pollinating crop, its flour ground

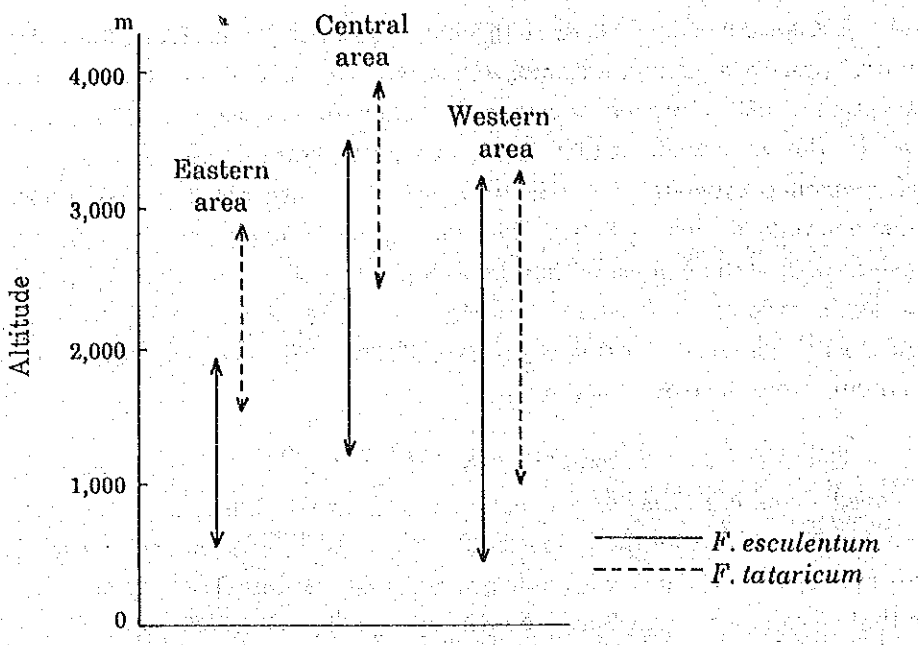


Fig. 2 Vertical distribution of buckwheat (genus *Fagopyrum*) in Nepal

from seed tastes bitter. This is the reason why the people prefer the common buckwheat to the Tartary so far as the climate allows.

4) Some characteristics of buckwheat collected from Nepal

Buckwheat is widely cultivated all over the country, and has been exposed to diverse climates, which are changed by altitudes. Naturally, varietal differentiation as for physiological and ecological characteristics are expected among local cultivars.

Some agronomic traits of the two cultivated species of *Fagopyrum* collected from the western and central areas of Nepal was evaluated at the Experimental Farm of the Faculty of Agriculture, Shinshu University, at Minami-minowa, Nagano Prefecture in Japan, where the altitude is about 800m.

Out of the common buckwheat collected at about 65 sites in the central and western Nepal, 48 strains were selected according to their original sites and altitudes and evaluated. Two representative Japanese varieties, "Botan-soba" (summer type) and "Kyushu-akisoba" (autumn type) were added to the test as

check varieties. Each of the samples was seeded at an interval of 5-6 cm in a single row plot, and 20 plants each of the samples were observed, though about 80-100 seedlings emerged per sample. Earliness of flowering was measured by the number of days from seeding to first flowering. Major characters, such as plant height, number of branches, number of flower clusters, number of matured grains and weight of grain, were measured at harvesting period.

One hundred and four strains of Tartary buckwheat collected from Nepal were selected according to their sites and altitude, and 50 seeds per each strain were seeded on 7th of July in 1987 at the same field and in the same manner as stated above for the common buckwheat. Data were collected with 20 plants in each of the sample in the same way as for the common buckwheat.

The major characteristics of each strain of common buckwheat are shown in Table 1. Except for the number of days to flowering, all the figures indicate mean values per sample. As shown in the Table 1, the Nepalese strains flowered later than the Japanese summer variety by about 11 days in average, and all of the Nepalese varieties flowered earlier than the autumn variety of Japan. The original altitude of each sample was not related to its number of days to flowering. For an example, the strain which required the longest period for flowering, namely, No.C-1, is collected from the highest site of the central Nepal at the altitude of 3,400m. Plants of Nepalese varieties were generally taller, and had larger number of branches than Japanese ones. The strains collected from the western areas were mostly uniform in terms of the number of grains per plant with the range of 25-60g. This character was not differentiated by original sites in the central areas. So far as this evaluation concerns, the Nepalese common buckwheat was not superior to Japanese ones in terms of the number of grains per panicle.

Table 2 and 3 show the mean values of the major characters for Tartary buckwheat from the central or western areas of Nepal. As for the relationship between the number of days to flowering and the altitude among those collected in the central areas, there was a tendency as shown in Fig. 3 that the earlier is the flowering, the higher is the altitude with a correlation coefficient of -0.69, which is statistically significant at 1% level. The correlation between the altitudes and number of days to flowering in the two areas is not significant as shown in this figure. In regards to plant height, those collected from the sites higher than 3,400m in the central area are shorter than those from other places. The number of matured grains per plant is differentiated greatly among the

Table 1 Major characteristics of common buckwheat collected from Nepal

Altitude (m)	No. of strain	Days to flowering	Plant height (cm)	No. of branch	No. of grain	Weight of 1,000 grains (g)
Western Area						
3,130	W-1	36.7	148.1	5.4	24.3	22.9
2,900	W-2	39.0	102.4	3.5	27.9	23.4
2,500	W-3	35.3	116.3	3.3	47.4	16.6
2,300	W-4	34.8	130.6	4.1	42.6	19.1
2,000	W-5	34.8	129.5	4.0	61.3	17.8
1,600	W-6	36.6	142.7	5.3	31.3	25.2
Central Area						
3,800	C-1	49.8	111.0	6.6	5.6	12.3
3,800	C-2	39.2	117.1	4.5	7.5	21.2
3,400	C-3	35.4	71.2	5.8	82.6	18.8
2,800	C-4	49.5	136.0	7.0	1.6	12.1
2,500	C-5	44.9	127.5	7.7	5.3	20.8
2,000	C-6	41.8	124.8	6.5	37.7	24.4
1,600	C-7	42.1	130.8	5.9	27.0	17.8
1,200	C-8	39.3	134.4	4.6	8.5	21.8
Japanese Varieties						
Botan-Soba		28.6	79.8	2.8	160.0	27.8
Kyûshû-Akisoba		34.5	111.0	4.4	164.7	28.6

strains in both sites, and not related to the site nor to the altitude of the collection. For instance, the strain No.54, collected at a low altitude of 1,000-1,500m in western area, showed the largest number of grains per plant with an average of 700 grains per plant. Weight of grain (grams/1,000 grains) varied slightly in the range of 18-22g, and not correlated to the site nor to the altitude of the collection.

Variation of the grain in its type, color and shape was studied in relation to the collection sites. The shape is mainly classified into round and slender. Both types were distributed in western areas, but only slender type was found in the central. Two grain colors were found in the central areas as shown in Table 3.

Table 2 Major characteristics of Tartary buckwheat collected from central Nepal

Altitude (m)	No. of strain	Grain type	Days to flowering	Plant height (cm)	No. of branch	No. of grain	Weight of 1,000 grains (g)
	62	SG	40.8	66.5	8.3	247	19.7
3,500	64	SG	43.0	58.1	9.7	260	19.6
↓	65	SB	41.3	62.1	9.6	345	19.4
4,000	74	SB	42.2	79.2	10.9	371	20.5
	75	SG	41.2	71.0	7.7	143	19.4
3,000	34	SG	38.1	75.7	4.0	78	18.8
↓	57	SG	45.2	90.2	10.5	358	20.8
3,500	59	SG	43.2	97.0	7.1	254	20.4
	60	SB	46.6	78.7	7.1	241	19.1
	29	SG	-	119.7	10.3	296	19.2
2,500	55	SG	46.4	101.8	11.0	206	20.8
↓	88	SG	41.8	113.8	4.1	145	21.4
3,000	89	SG	41.4	108.7	4.7	181	18.6
	90	SG	42.6	63.6	9.2	320	19.6
2,000	22	SG	47.6	139.5	9.3	174	21.0
↓	23	SG	58.6	149.6	13.5	309	20.2
2,500	25	SG	-	135.6	13.0	269	18.9

* Mean value per plant
** S: Slim (shape)
G: Greish brown(color)
B: Black (color)

From the preliminary evaluation of the buckwheat stated above, the common buckwheat seems to be widely cultivated from low altitude regions to mountainous regions, while the Tartary buckwheat is distributed from the middle altitude to as high altitude as crop cultivation is possible. The distribution pattern is found different among collected areas.

All the Nepalese common buckwheat which showed delayed flowering in comparison with Japanese varieties are mostly belong to autumn type. Besides, Tartary buckwheat was classified into two types based on plant height and number of branch; i.e., one is tall or elect type, which is only found at high altitude and the other is small or bushy type, which is only found at high altitude region of northern parts in the central Nepal. Generally, Tartary buckwheat seems to have potential to produce a large number of seed per plant, and to be promising as breeding materials in future.

Table 3 Major characteristics of Tartary buckwheat collected from western Nepal

Altitude (m)	No. of strain	Grain type	Days to flowering	Plant height (cm)	No. of branch	No. of grain	Weight of 1,000 grains (g)
	11	RG	49.1	115.8	10.2	397	20.2
2,500	12	SG	47.7	122.6	7.6	378	21.3
〃	13	RG	46.9	128.4	9.7	337	21.1
3,000	15	RG	50.6	118.4	10.4	435	20.5
	16	SG	47.4	126.6	11.6	657	19.9
	1	RG	48.3	97.3	9.9	447	20.9
2,000	2	RG	47.7	104.8	8.3	333	22.5
〃	4	RG	50.4	100.7	9.1	214	22.2
2,500	8	SG	45.7	125.6	10.3	337	22.1
	9	RG	49.9	116.3	9.6	533	20.0
	48	SG	48.7	131.9	8.9	231	21.0
1,500	49	SG	48.0	140.0	11.6	408	21.8
〃	50	SG	49.6	131.3	8.5	247	21.5
2,000	98	RG	47.9	111.7	11.7	111	18.0
	100	RG	63.5	121.5	14.0	154	21.1
1,000	45	RG	50.4	122.0	10.0	306	20.9
〃	52	SG	47.4	135.6	8.6	335	21.0
1,500	54	SG	–	110.0	12.5	707	22.0

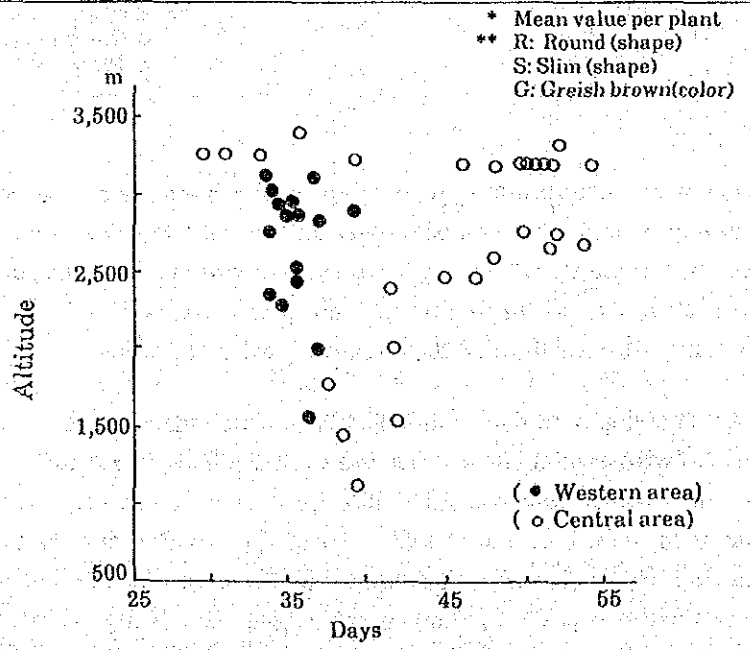
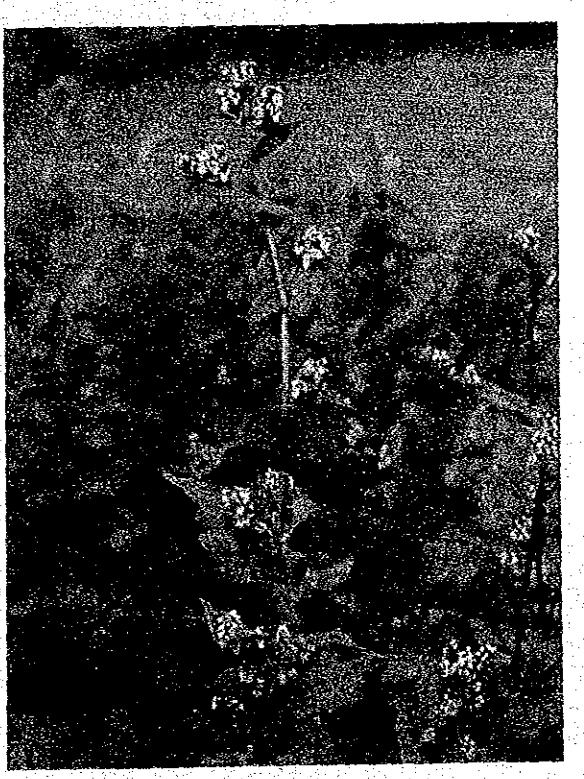
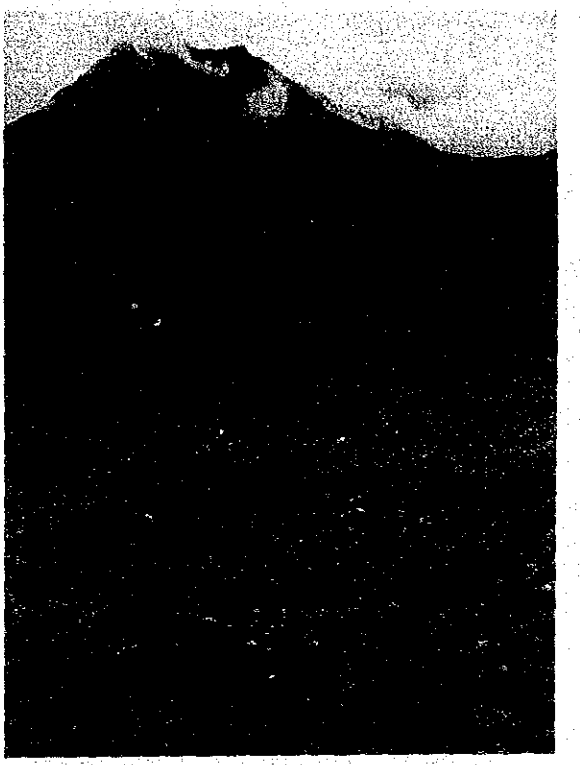


Fig. 3 Correlation between altitude and number of days from seeding to flowering in Tartary buckwheat

Common buckwheat in the sub-tropical zone of Central Nepal (alt . 300m)



Tartary buckwheat in West Nepal (alt. 2,800m)



Common buckwheat in a high altitude zone of Central Nepal (alt. 3,600m)

A terrace field of common buckwheat in Central Nepal (alt. 2,600m)

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