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Farmers' Indigenous Knowledge of Sweet Potato Production and Utilization in the Cordillera Region

Rosana P. Mula

USER'S PERSPECTIVE WITH AGRICULTURAL RESEARCH AND DEVELOPMENT (UPWARD)

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User's Perspective with Agricultural Research and Development

UPWARD is a network of Asian and South Pacific researchers dedicated to the involvement of Technology users in sweetpotato and potato research and Development. It is sponsored by the International Potato Center (CIP) with funding from the government of the Netherlands

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FOREWORD

The dominant model of agricultural research throughout the post-war period can be described as "top-downism". This linear model has involved the centralized development of component technologies and the outward and downward transfer of technology packages through various stages of the science-practice continuum to the passive technology consumer - the farmer. "Green Revolution agriculture" has been one of the remarkable successes of the model. Though assessments of its impact have varied dramatically over the past twenty-five years as intellectual fashions have changed and as new data have become available, there is no doubt that the new technical packages of modern varieties plus fertilizers, pesticides and crop and water management practices have brought significant economic and social benefits to many developing countries.

But in the midst of success, there are serious problems. The need for increased inputs to sustain current productivity levels raises urgent questions about the viability of the existing technology and use of resources. Our immediate concern here, however, refers to the many parts of developing world agriculture which the Revolution has failed to reach. The new technology has principally benefitted more highly capitalized farmers located in favored "core" agricultural areas - especially the deltas, river valley systems and coastal plains of Asia. Large numbers of poor farming families in more marginal, upland environments have been virtually bypassed by the revolution. Marginal, low-input agriculture is more risk-prone and usually much more heterogeneous than Green Revolution agriculture, with diverse crop mixes, including roots, legumes and tree crops and numerous interdependencies between crop, livestock and other production sub-systems as well as along the food chain. In this kind of agriculture decision-making and technological needs are highly complex. The vertical R&D model is ill-equipped to deal with this complexity since it cannot easily tap the main source of expertise on these systems: the local users themselves.

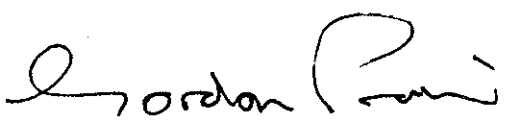
The UPWARD network is part of a growing alternative approach to agricultural R&D which seeks to reverse the dominance of top-downism by starting the research process with the perspectives of users so as better to identify research needs and opportunities and jointly design solutions. We seek also to reflect the real social context of user decision-making, working with households and other groupings, not just with individuals; with women as well as with men; with the old and the young, not just the middle-aged family head; Recognizing the importance of food system linkages, studies address marketing, processing and consumption issues, as well as production. The network stresses partnership with local people and close interdisciplinary links with colleagues to maximize our understanding of cultural, biophysical and socio-economic dimensions of local agriculture.

UPWARD's focus on rootcrops and especially sweetpotato to illustrate this approach to research has proved highly appropriate for several reasons. Sweetpotato is one of the developing world's most widely distributed and versatile crops, adapting relatively easily to a range of cropping systems and is thus a good candidate for diversifying and intensifying food systems. It has been commonly found as an alternative staple in upland systems and homegardens as well as a diversification crop in lowland systems. The bulk and perishability of rootcrops and their vegetative reproduction raise a whole series of food systems questions and problems about conservation (including via processing) storage, marketing and the maintenance of planting material. Sweetpotato is also a nutritious crop, with significant production of edible protein and important quantities of micro-nutrients and is thus potentially important for improved household nutrition. Yet of all major food crops, sweet potato has probably received least attention within research activities, It is thus an excellent moment to implement a participative, food systems research and development approach to the crop.

UPWARD's main research achievement so far has been a user's perspective diagnosis of sweetpotato in Asian food systems. Researchers have worked with users to illuminate the different production systems, distribution channels and utilization patterns of sweetpotato in different countries of the region. This Working Paper

series offers UPWARD researchers the opportunity to share some of the results of these diagnostic studies with a wider audience. It is appropriate that the first Working Paper presents results of one of the first UPWARD projects, Anna Mula's study of indigenous knowledge and practices associated with sweetpotato agriculture in the Cordillera mountains of the northern Philippines. This is an area where sweetpotato has been an important staple crop in the past but where the introduction of commercial vegetable production and other changes are causing shifts in the role of sweetpotato. Choosing a number of sites undergoing different transformations Ms. Mula shows that though the role of sweetpotato is different, local people maintain similar indigenous cultivation practices indicating their flexibility of adaptability.

She rightly cautions against "kneejerk" development intervention before understanding the implications of these findings. Her own approach is an excellent example of participation in practice: involvement of local people directly in the validation of diagnostic results and in the identification of appropriate future actions.



Gordon D. Prain
Coordinator

UPWARD
Working Paper #1

ABSTRACT

In the Cordillera region of the Philippines, located 250 kilometers north of Manila, sweetpotato is an important crop especially in areas where development is slow. This study is a documentation of farmers' indigenous knowledge of sweetpotato production and utilization.

A detailed description of the sweetpotato subsystem was obtained through Rapid Rural Appraisal and Participant Observation. Findings were presented in a dialogue-forum in an attempt to come up with research concerns or recommendations that can serve as springboards for follow-up actions or subsequent investigations.

Most of the sweetpotato grown in the Cordillera uplands are for home consumption basically as a staple or supplement to rice. Production and utilization practices/technologies among each ethnolinguistic tribe are almost similar. However, a difference lies on the local names and terms for these practices. Sweet potato production and utilization practices are traditional, indigenous and site specific. Most of these practices are still existing to date.

Sweetpotato is a woman's crop. The study revealed that women know more about sweetpotato than men and this was validated by the participant observation. A dialogue-forum held to present research results to farmers was attended by 99% women.

The rise of commercial farming with use of technology packages biased toward cash crop production has marginalized the crop. While there is evidence of sweetpotato commercialization in some areas of the Cordillera, this is not widely observed. Sweetpotato has minimal economic advantage compared with other cash crops even if the latter's production proves more risky. It is a survival crop.

The study recommends that before an attempt to invade the boundaries of the sweetpotato subsystem (e.g. increasing productivity) is done, it is best to elicit the farmers' knowledge and perspective on the crop, an indispensable inputs in a program design aimed at finding solutions to problems and needs.

CONTENTS

INTRODUCTION

Folk technology or farmers' indigenous knowledge is vital in any attempt to make sound recommendations for developing crop production and utilization practices. Indigenous knowledge is the sum of experiences and knowledge of a given ethnic group that forms the basis for decision making in the face of familiar and unfamiliar problems and challenges (Warren and Cashman, 1989).

Several studies have proven that farmers are experimenters in their own right. Newly established potato production in Oxapampa, Peru was developed by highland farmers called "serranos" who migrated in the new area bringing with them their cultural baggage, including beliefs about what tastes best and what can be grown (Rhoades and Bebbington, 1988). In the Philippines, farmers in Tupi, South Cotabato are able to sustain the productivity of their rice and maize, by practices and technologies they developed in spite of the erratic rainfall that considerably reduces rice yield (Fujisaka, 1989).

The Cordillera region has its own agricultural system. But the last decades were marked by changes in the traditional agricultural system. The "uma" (swidden field), which was once planted with sweetpotato as a staple food, has progressively been converted into commercial gardens particularly in Benguet. This is a consequence of rapid population increase, road networks and commercialized farming. Even dipterocarp forests are being converted to commercial farms, endangering the ecological balance of the area.

However, there are still those who stick to folk technology. Branded as backward by technocrats in ivory towers, folk technology users still cling to their sustainable agricultural practices rather than change these to what they do not fully understand and cannot afford.

Sweetpotato farmers in the Cordillera, particularly the "kankanaeys", still maintain indigenous practices in sweetpotato production and utilization.

APPROACH AND METHODOLOGY

Agro-ecosystems Analysis which focuses on the identification of "best bets" for research and development (McCracken and Conway, 1988), was used to document farmers' indigenous practices. Figure 1 outlines the key variables of interest and the perspective that guided the inquiry.

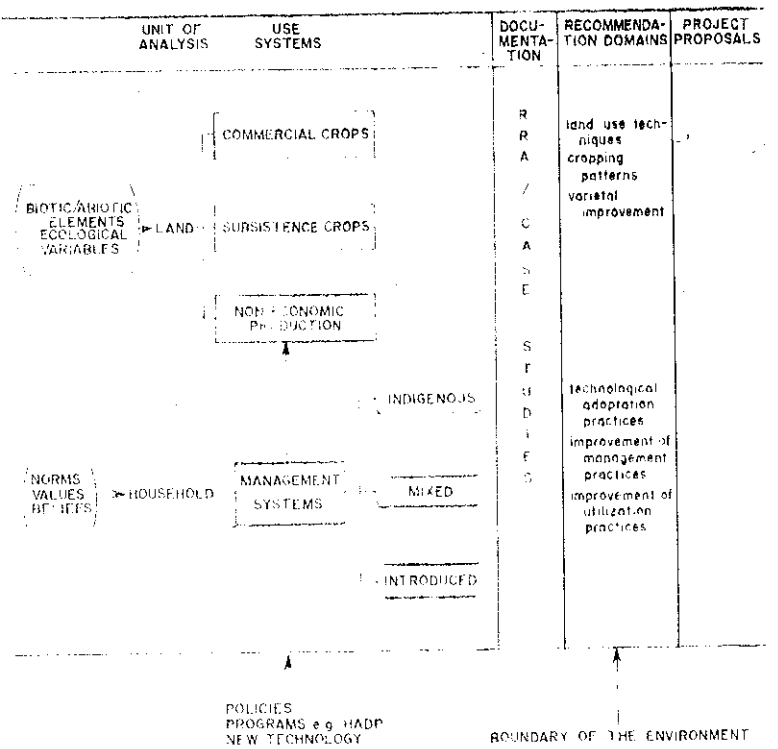


Fig. 1. Schematic diagram of key variables of interest and perspective that guided the inquiry.

The following methdological tools aided in the study.

a. Rapid Rural Appraisal (RRA). A multi-disciplinary team of researchers immersed in the different sites for almost one week. In Tuba and Bayyo, a research assistant in each site stayed in the village for almost two months. Data were collected through informal interviews and participant observations.

b. Validation/Consultation. Information gathered during the RRA were verified and validated through a dialogue-forum in which farmers from the study sites, researchers, policymakers, academicians, and non-government groups participated. The activity was an avenue for the policymakers and researchers to consult the farmers. Thus, researchable areas on sweetpotato production were identified.

c. The Study Areas (Figure 2). The Benguet municipalities of Bakun and Kapangan were the study areas to generate indigenous knowledge of sweetpotato production and utilization. The former was selected because it is the most depressed municipality of Benguet while the latter is said to be producing sweetpotato on a commercial scale.

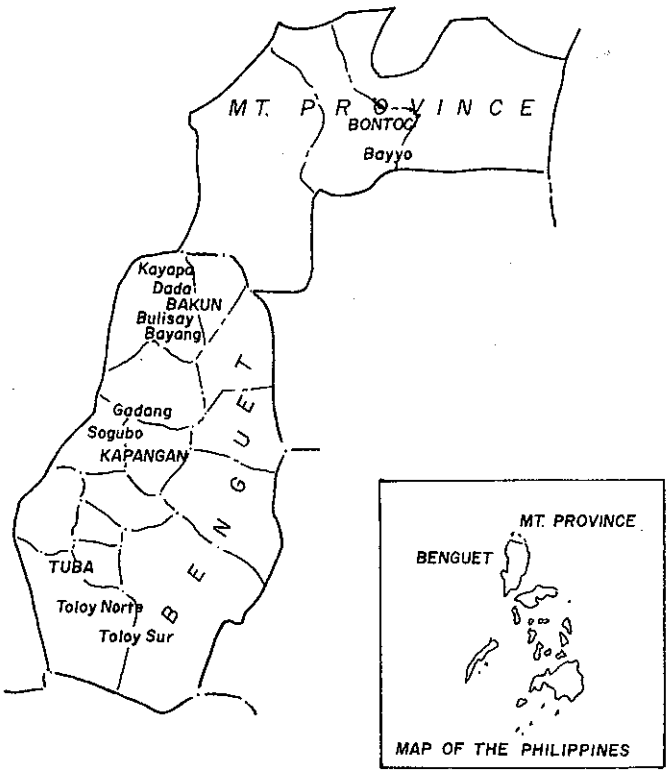


Fig. 2. The study areas.

The sites selected for participant observation were Tuba, Benguet and Bontok, Mountain Province. Tuba was selected because of its proximity to a market center while Bontok, particularly Barangay Bayyo, was chosen because sweetpotato is grown the whole year round.

SWEETPOTATO IN A POOR SUBSISTENCE COMMUNITY: BAKUN, BENGUET

Bakun is situated in the northwestern tip of Benguet (Figure 2). The four barangays of Dada, Biyeng, Bulisay and Kayapa Proper were selected to represent the diversity of the area. These sites have fairly homogeneous agro-ecological zones comprising of an upland terraces, and a river (Figure 3).

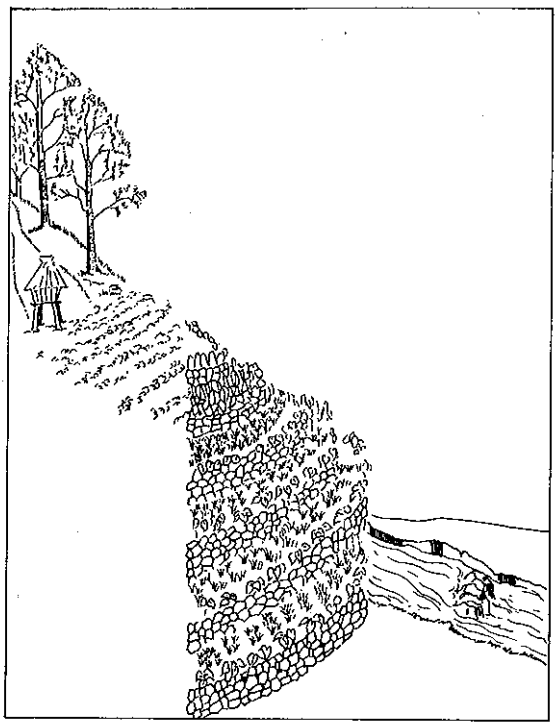


Fig. 3. Agroecological transect of Bakun, Benguet.

Overview of the Farming System

Farmers in these four barangays, who are generally kankanaey-speaking, are producing crops on a subsistence level, i.e., home consumption. A few of those in Bulisay, Biyeng, and Kayapa obtain cash by selling crops, livestock, and handicrafts. Some farmers in Kayapa who speak the Ilocano dialect would barter their crops for salt, tobacco, bread and used clothings with the people in the neighboring lowland towns of Ilocos Sur.

In the southern part of Bakun, particularly Kayapa, where the elevation is lower than in the three sites (approximately 1,000 meters above sea level), sweetpotato is cultivated either with pigeon peas, lima beans, taro, or banana (Figure 4). Mixed cropping is practiced to supply the household with different food during the growth of sweetpotato. Lima beans and pigeon peas are harvested the whole year round.

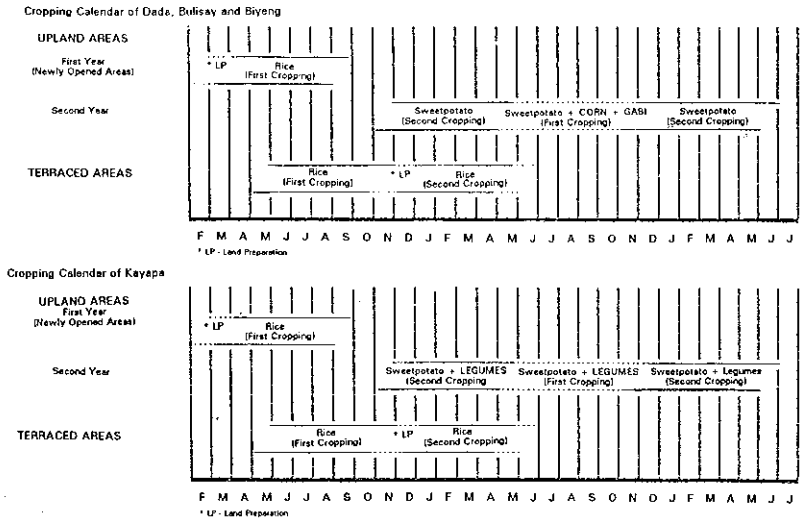


Fig. 4. Cropping calendar of Bakun, Benguet.

Sweetpotato Farming System

Land Preparation

Swidden cultivation locally known as "uma" is the common practice of land clearing in sloping areas of 18 degrees and beyond. Land clearing is done manually using hoes and "sanggap" (weeding tool). Most families engaged in "uma" cultivate more than one site as a form of food insurance. The average size of one "uma" is 0.5 hectare although some own more than one hectare of non-contiguous farm. In terms of distance of the farm to the settlement, the closest is approximately one kilometer and the farthest is five kilometers.

Nowadays, land clearing in Bakun is basically governed by ownership, unlike before when primi occupantis was practiced for the purpose of clearing virgin lands for swidden farms and pasture (Tapang, 1985). By ownership, the land under clearing is tax declared. However, lending or borrowing of "uma" is also common in the area. The right to use the land is usually under informal arrangement such as a verbal agreement whereby the cultivator is free to use the land until the owner retrieves it. In most cases, the cultivator voluntarily shares some of his produce with the owner apart from making improvements to the land such as fencing.

In contrast to Mountain Province where households engaged in "uma" have the right to share the use of the "uma" with other households, Benguet operates on an individual basis (Caces, et al., 1987). Clearing the "uma" is generally a man's job, although cultivation is mostly performed by women. The usual farm work

includes planting, weeding, harvesting, hauling, as well as processing of harvested roots. Children also help with farm chores.

Varieties

Eight sweetpotato varieties are grown by farmers - three traditional and five introduced (Table 1).

The three traditional varieties are "iligey", "gayyadek", and "usigay". The latter is widely grown because of its yield, good tops, and significant resistance to sweetpotato weevil (locally known as "bigis") and to browning of the leaves (locally known as "kulput").

The five introduced varieties are "kalbo-oy" also known as "kilatan"; "balbalanga"; "tadpook" also known as "tokano", and "balloling"; "sanaay"; and "makaligong" also known as "mamon" and "kaligong". Of these, "kalbo-oy" is most widely grown.

However, in terms of area, farmers cultivate more of the introduced varieties than the traditional ones. Sometimes, two or more of the varieties are combined in one area as a form of insurance. Farmers are known to have preferences for certain eating and cooking qualities (Lightfoot et al, 1987). In the area, farmers are not so critical about taste. They opt for high yield over eating quality because there is no other major source of food. Although rice is grown, it is not sufficient as a staple food and sweetpotato is also needed.

Old folks mentioned three other varieties previously grown (Table 1). Most of the farmers reported that the disappearance of these varieties was mainly due to the abandonment of swidden field during the outbreak of the second world war. This was aggravated by rat infestation of sweetpotatoes left unharvested in the fields. Three years after the war, planting materials became so scarce that most farmers were forced to import sweetpotato vines from neighboring towns.

All respondents posited that traditional varieties are high yielding. One matured root may grow to the size of an average thigh. They are tasty and are more resistant to pests and diseases.

Farmers claimed that "usigay" belonged to one of the oldest local sweetpotato varieties in the area. They have been planting it even before the second world war. It thrives best in clayey to sand-clayey soils. It is characterized by rounded leaf tips, light red midrib and petiole, and non-hairy shoots good for viand. Roots are red and smooth but sometimes slightly coarse, and are round to oblong in shape. The flesh is white. If immediately cooked after harvest, the taste is bland, but it can be ripened in three to four days. It can also be grown the whole year round.

Table 1. Sweetpotato varieties currently grown in Bakun.

	VARIETY	CHARACTERISTICS
A.	Traditional Varieties	
1.	"danggi-an"	
2.	"iligey"	- high yielding with one matured root reaching
3.	"gang-esang"	the average size of the thigh
4.	"bukagan"	"nabukag" mealy
5.	"gayyadek"	
6.	"usigay"	- the only traditional variety grown by by new farmers in the area - it has been planted for more than 20 years - it thrives best in clayey to sandy-clay soil - it is characterized by rounded leaf tips, light red midrib and petiole and non-hairy shoots good for viand. - roots are red in color, smooth but sometimes can be slightly course, and are well formed: round to oblong in shape. - the flesh is white - it can be ripened for three to four days - if immediately cooked after harvest, it taste bland - it can be grown the whole year round
B.	Introduced Varieties	
1.	"kalbo-oy" or "kilatan"	- a variety widely planted in the area - it has white skin and white flesh - high yielding - nowadays, this variety degenerated: it produces roots that are fibrous and with cracks
2.	"balbalanga"	- it is a newly introduced variety only about five years ago - the vine is red violet, the underneath of the leaves is dark violet, hairy tops, and pointed leaf tips - roots are white to pinkish - the flesh is white to slightly pink in color - when immediately cooked after harvest or even after storage, the flesh is dry and taste bland - when planted in newly opened "uma", the vines can be very robust which produce lesser number of roots and often smaller in size - it is very sensitive to hot climatic conditions - it is best planted during the onset of the rainy season - it thrives best in sandy to a mixture of sandy-loam soil
3.	"tadpook" "tokano" "balloling"	
4.	"sanaay"	
5.	"makaligong" "mamon" "kaligong"	- planting material from the neighboring towns of Ilocos Sur - early maturing (approximately three months) - prolific vegetative growth

The origin of "Balbalanga" can not be traced by the respondents. Farmers from Kayapa said the variety came from neighboring lowlands while others who hail from the upper parts (i.e., Bulisay) claimed the vines came from Bakun Central. This variety is not very popular since it was only introduced about 5 to 6 years ago. The vines are red-violet while the leaves are dark violet. The tops are hairy. It has pointed shoot tips. Roots are colored white-pink while the flesh is white to slightly pink. When cooked immediately after harvest or after storage, the flesh is dry and tastes bland.

The respondents claimed that when the variety is planted in a newly-opened "uma", the vines are robust and produce lesser number of small roots. This variety is believed to be very sensitive to hot climate. It is best planted during the onset of the rainy season and thrives best in sandy and sandy-loam soil.

"Kilatan" or "Kalbo-oy" is planted by most farmers in the area. It is called as such because of its white flesh. "Kilatan's" root word is "kilat" meaning white in the local dialect. It is planted not only in Bakun but also in the entire Cordillera. It is popularly planted because of its high yield and quality roots. However, the farmers have observed that through time the variety has degenerated. Nowadays, the roots are fibrous and are cracked. According to them, such characteristics may be due to declining soil fertility and erratic climatic change (i.e., prolonged rainfall and drought).

Planting Materials and Planting Methods

The farmers usually get their planting materials from the apical portion of old plants or the healthy portion of old vines (about 3/4 of the entire vine length).

During the dry season, the cuttings are stored for at least one week in moist and shaded areas.

The method of planting consists in placing two cuttings side by side in one mound of about 30-35 centimeters in diameter and 7-10 centimeters in height (Figure 5). The distance between cuttings is approximately 6 to 8 centimeters.

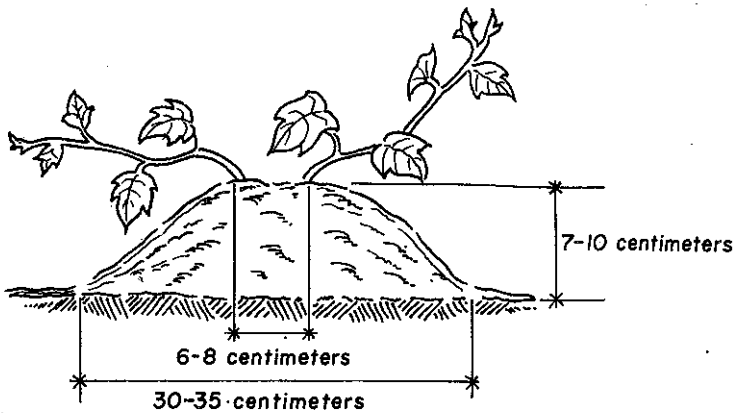


Fig. 5. Method of planting, distance between cuttings, and the height of a mound.

Resource Management

Commercial fertilizers are never applied. However, farmers have various ways of sustaining soil fertility such as leaving the "uma" to fallow for about three to five years after using it for a maximum of one to two years, intercropping with leguminous crops and other rootcrops, and crop rotation (only with rice).

Although cow manure is abundant in the area it is not collected for use as fertilizer. The reason given is that manure gathering is too time consuming, considering the distance of their pasture land.

To conserve soil, the "uma" is provided with border canals or embankments to stop surface run-off. through their experience in swidden farming farmers are aware of the destructive effect of surface run-off.

Initial clearing of the "uma" involves only partial removal of vegetation. Big trees are cut back and small trees that could serve as trellises for leguminous crops are maintained. Quite often, areas with thinner vegetation especially fewer trees are preferred for the "uma".

Pests and Diseases

The only control measure for weevil (*Cylas formicarius* fabr.) a major sweetpotato pest, is to harvest the roots at one time. Allowing the roots to stay longer underground makes them vulnerable to weevil damage and can lead to poor eating quality such as fibrousness and crunchiness ("nagares").

Rats or "aggabas" are also serious pests posing a serious threat to food security. They eat almost everything -- sweetpotato, rice, and vegetables. Surprisingly, rat infestation in Bakun had reoccurred very recently after twenty years. According to the local people the recurrence started in the middle part of 1989 when typhoons and prolonged monsoon rains heavily struck Northern Luzon which includes Benguet. They also associated the problem with the flowering of the "anes" and "bika" (a type of bamboo grass). According to Lakay Tayag (key informant), reputedly to be the oldest man in Kayapa, flowering of the wild bamboo occurs every 20 years. An each time this happen, a "betil" is expected. This is a local term for the catastrophe oftentimes associated with famine lasting for about three years depending upon the rejuvenation of this wild bamboo. Rats, to the old folks, were called "siba" which means "famine". Even if there are no scientific explanations for the phenomenon, such an invaluable information serves as "warning" or "reminder" for the townsfolk to look for alternative sources of livelihood. During "betil", the men often seek casual work along the Mountain Trail as road crews.

Asked how rats are controlled, the farmers said they have applied pesticides but to no avail. The presence of predator birds such as "acop" and "labaan" are claimed to minimize rat infestation. These birds, once abundant, are now rare. This is because people hunt them since they also prey on chickens.

One plant, the "tokbo", was identified as a potential measure for rat control. Its leaves kill the rats slowly due to extreme itchiness caused during contact. It is a good control against rodents when planted around the "uma". However, the plant also has dangerous effects on humans and animals.

For "kulput", farmers do not have any control measure except by removing the affected parts and burning them.

Harvesting

Cultivation of sweet potato in mounds is important according to the farmers because this is usually where the roots are formed. It also serves as a guide during harvest, thus minimizing injuries to the storage roots (Villamayor 1987).

Harvesting is commonly done through priming. First priming is done 5 to 6 months after planting and the succeeding ones take place every two months, resulting in three harvests per season. Depending on the size of the household, a common practice among the subsistence farmers is daily harvesting. The needs of the livestock subsystem are also considered. Any kinds of roots, including damaged ones, can be fed to swine, dogs and chickens.

During the wet season, farmers know that sweetpotato is ready for harvest through signs like the bulging at the base of the plant and occasionally the emergence of matured roots from the soil. Towards the drier months, signs observed are leaf senescence and cracking of the soil. The most common tool used in harvesting is the "so-an" a pointed metal implement.

Post-Production Practices and Utilization

In all the study sites, harvested roots are placed in an "akgo" (a wooden bamboo tray) and thoroughly washed. The most common preparation of sweetpotato roots as food and as animal feed is simply done by boiling. The decoction/broth left after boiling is called "sabeng". It is left to ferment (approximately two weeks in Kayapa and three months in Dada, Bulisay and Biyeng). "Sabeng" is commonly used as an alcoholic beverage, vinegar, and a cure for stomach disorders, especially diarrhea.

If there is a surplus, which seldom occurs, "buku" or chips are made by sun drying thinly sliced sweetpotato pieces on top of flat big rocks called "pila". The chips are intended for food during the rainy season. Dried chips are stored in plastic sacks and last for about three months. Pounding is done on a staggered basis depending on the food requirement of a household. The pounded chips are stored in clay jars called "koli" which have a capacity of 50 to 60 kilograms depending on the size. The "koli" is tightly sealed with dried banana leaves and the stock could last for about five months to one year. When cooked, this is mixed with rice or sometimes with sugar if available.

SWEETPOTATO AS A SMALL SCALE COMMERCIAL CROP: KAPANGAN, BENGUET

Overview of the Farming System

The municipality of Kapangan is located in central western Benguet (Figure 2), with a total land area of 17,327 hectares and an altitudinal range from 200 m.a.s.l. to 1,700 m.a.s.l. Most of the flat irrigated land is devoted to rice production and there is only very limited area for commercial vegetable growing.

Inhabitants belong to two distinct groups, namely, the "Kankanaeys" and the "Ibalois". People engage in small scale farming of both livestock and vegetables, broom making, and sericulture. The latter was recently introduced and is currently financed by non-government organizations.

The study focused on barangays Sagubo and Gadang.

Sweetpotato Farming System

Land Preparation

Sweetpotato farmers in Kapangan still adhere to a traditional cultivation system known as "num-a", meaning "to clear" in the native dialect. It is the common way of preparing the land.

Land clearing starts in December. Cut trees and weeds are left to dry for a couple of days and then burned to serve as fertilizer for sweetpotato. Planting falls in the months of January to February (Figure 6).

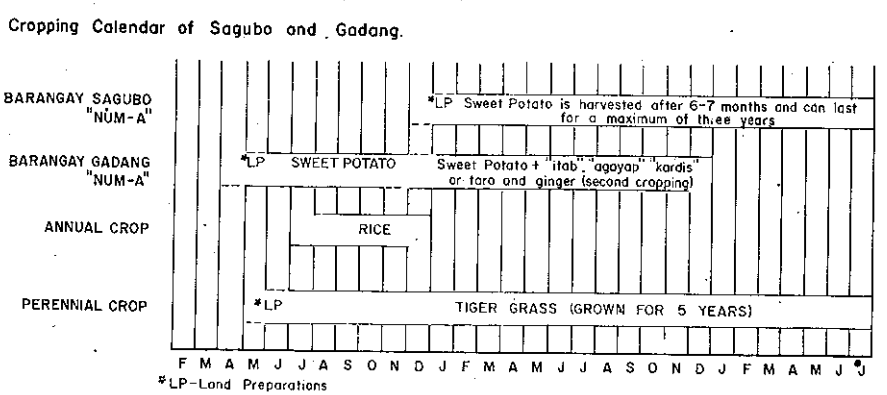


Fig. 6. Cropping calendar of Kapangan, Benguet.

Varieties

Three to four varieties are planted in a "num-a". Of the 13 locally identified varieties, six are preferred by the farmers of Sagubo. These are "gayabangan", "ka-ngao", "sumabela", "amsitan", "balingway" and "kalbo-oy". In gadang, only three are preferred. These are "kalbo-oy" "amsitan" and "sumabela". The farmers preference is due to the varieties' high yield, good taste, and good tops for viand. In the recent past, farmers had bountiful harvests from their crops. Today, a decline in yield and quality has been observed, especially for varieties that have been planted for a long time. While no causes are specifically identified by local people, the phenomenon is believed to be due to the continous use of the varieties in the same environment, making them susceptible to pests and diseases and thereby affecting the yield.

It was also learned that varieties are usually named after their place of origin or their characteristics. For instance, the "amsitan", with its root word "amsit" meaning "tasteless", is a variety that tastes bland while the "ka-ngao", which means "brought in", is a newly introduced variety (Table 2).

Planting Materials and Planting Methods

Two stem cuttings usually measuring a foot long or more are planted per "bang-bang" (mound or hill). The distance between the cuttings is approximately 5 to 8 centimeters and the distance between hills is about 30 centimeters.

The size of cuttings depends upon the season and the maturity of source. During dry season, the cutting is shorter and when the source is from a young vine, the cutting is usually longer. This practice enhances the chance of survival for the newly planted cuttings.

"Latong" or "bitang" or stem cuttings are stocked in moist places for at least three days prior to planting. This practice is called "maib" and is done to hasten rooting to ensure better chance of survival.

Table 2. Most preferred sweetpotato varieties in Kapangan.

	VARIETY	CHARACTERISTICS
1.	"ka-angao"	- reddish leaves - red skin and white flesh - three months maturity - new variety (introduced three years ago) - when cooked. or taste sweet and dry - when it is overmatured, the root becomes fibrous - tops not so good - high yielding (continuously produce roots)
2.	"bi-biit"	- three months maturity
3.	"kalbo-oy" or "kilatan"	- this used to be widely grown until "ka-ngao" was introduced - high yielding - good tops - mealy when cooked
4.	"gayabangan"	- watery and it gets easily dessicated when cooked - good for livestock
5.	"pitayan"	- watery and it gets easily dessicated when cooked - three months maturity - good for livestock - could be grown in the "num-a" for three years
6.	"balingway"	- high yielding - four months maturity - could be grown in the "num-a" for three years - good for ripening - sweet and moist
7.	"sumabela"	- mealy - three months maturing - red skin, yellow flesh - high yielding - could be grown in the "num-a" for three years - originated from Isabela
8.	"amsitan"	- high yielding - three months maturity - tasteless ("natamnay")

Harvesting and Post-Production

Sweetpotato is harvested 6 to 7 months after planting when most of the sweetpotato roots have matured. Determination of harvest readiness depends on knowing the variety's specific vegetative period and sampling by priming and/or observing the mounds where the sweetpotato vines are planted. If the mounds show signs of bulging near the main vine, roots are ready for initial priming. According to most farmers interviewed, prior to initial priming, mound layering is practiced to enhance root development. The hilling-up is done during weeding, two to four months after planting in order to prevent greening of exposed tubers.

The most common tool for harvesting is a pointed iron bar, about one foot long called "so-an". Women do the harvesting because they are good at it, according to the male farmers. Old women who were asked how they avoid injuries to the roots said that priming is done by pricking the priming bar at the base of the mound to avoid the areas where there are visible signs of bulging. The free hand is then led by the priming bar where the root is situated. The priming bar is then stuck under the base of the root to force the root out from the soil using the body as a lever. Mechanical injury is not always avoided, but the mastery of the sequence has become an art among the older women who have harvested sweetpotato most of their lives.

Handling of harvested roots is often done by exposing the roots in the field during priming. These are then collected, with the diseased roots segregated for livestock. Only the good ones are further sorted in the priming area. Another method of handling is by carrying the roots on the back with a basket called "kayabang". When the carrier gets tired due to the heavy load, the roots are piled in a certain area and then carried again after sometime. This is done where the farms are located in steep areas. Sweetpotato vines gathered from the "num-a" are fed to the livestock. Sweetpotato is only sold when there is a surplus, especially during the lean months when farmers sell their sweetpotatoes at P2.50-P3.00/kilogram (1990 prices). Traders from Baguio City usually buy the sweetpotato roots on a per kilo basis in the rural areas and resell them in the city. Some farmers sell their produce directly in Baguio City. For transport costs, farmers spend about P15.00/sack (30-50 kg) and P25.00/basket (50-70 kg). Marketing is done in July, August, and September, the months when sweetpotato is scarce in Baguio markets.

Income from sweetpotato is used to buy basic household commodities like sugar, salt, and sometimes rice. Sweetpotato roots preferred by traders are medium to big, relatively good-shaped and with

minimal mechanical damage. By observing strict grading/classification farmers can demand better prices and make it easier to find a buyer. Though the red skinned sweetpotato is more easily sold, there are no preferences for other varieties and they are often mixed during selling.

Because of low yields experienced during the last five years sweetpotato are seldom stored. Production is barely enough for household consumption. Low yields are attributed to the variety planted, declining soil fertility, and the changing climatic conditions. There is no recognition by farmers of their own responsibility through denuding the mountain areas, over-grazing in open fields, and cutting the remaining forest stands.

Key informant Manuel Sagudan said that during the past two to three years, the water level in the normally abundant creeks decreased drastically, limiting most farmers to one-season planting of crops in irrigated fields. Rice fields from the top of Sagubo were not planted during the team's visit due to water scarcity. Farmers who were asked to comment about the situation said that the drying-up of the creeks was caused by prolonged drought. Rain that usually comes in March-April has not occurred they said.

They added that most farmers delayed their planting schedules because of the drought. Sweetpotato planted last January/February was replaced because it dried up.

Storage of processed roots is rarely practiced due to relatively low yields. However, in some parts of the barangay where surplus exists, sweetpotatoes are peeled, sliced to about two to three millimeters in thickness and dried under the sun for three to seven days. These are then stored to serve as food during the rainy season and prepared by pounding dried chips to make flour. The floured form can be stored for longer periods.

Among households with large areas planted to rice or with members employed outside the village, sweetpotatoes are seldom used as a main food. Earned wages are usually used to purchase rice and other basic commodities. However, in one village in Gadang, sweetpotato is eaten three times a day at the onset of the rainy season. This is the time when sweetpotato crops planted the previous year (November or December) are harvested. Sweetpotato roots are primarily cooked by boiling and made into flour by steaming. Farmers who described the preparation of floured sweetpotato said it is best prepared by mixing pounded glutinous rice and some sugar. If peanuts are available, they are ground and mixed with the floured sweetpotato and then wrapped with banana leaves.

Fresh roots are either trimmed at the apical ends or peeled and then boiled. Unpeeled roots are directly cooked when there is limited

time available. The skin is removed before eating. The decoction derived from boiling roots is used for making a sour-tasting wine called "tengba". It is also used as vinegar and medicine.

For use as wine fermentation requires at least one week and up to one year in storage. The fermented solution can be a potent drink when salt is added. As vinegar, the decoction is fermented for about 7 to 15 days to cause souring and then used immediately. Both preparations can be used as medicine. The most common diseases that the solution can cure are diarrhea, amoebiasis, stomach pain, minor burns, and or hangover from overdrinking rice wine or liquor, farmers who are heavy drinkers recommend it for curing intoxication.

SWEETPOTATO IN A COMMERCIAL VEGETABLE PRODUCTION COMMUNITY: TUBA, BENGUET

Overview of the Farming System

Tuba is a municipality of Benguet where subsistence farming has been displaced by commercial vegetable production. The sweetpotato and banana crops which were grown in the "uma" in the past, are hardly considered as important crops by most farmers today. Communities within the municipality have shifted to vegetable farming in spite of the risks involved. The change was particularly rapid in the late 60's with the advent of the road network linking farmers with expanding markets and credit facilities particularly associated with Chinese business operations based in Baguio City and La Trinidad Valley. The study barangays Taloy Sur and Taloy Norte (Figure 2) were the only sites in tuba still producing sweetpotato according to the intital informal survey conducted last March 1990.

Apart from documenting indigenous knowledge of sweetpotato, this study also examined the changes that have occurred in the agricultural system of the area.

According to most respondents, these barangays were merged in the early 40's. There were no barangay roads. People hiked for half day to reach Central Tuba. In 1982, barangay roads were opened in Taloy Sur, Taloy Norte and in other areas close to Central Tuba. Because of the tremendous increase in population, authorities were prompted to divide the barangay into two to facilitate governance. In 1970, the Marcos national highway linking Tuba to La Union and Pangasinan was constructed and completed in 1991. This paved the way for the cultivation of cash crops such as "chayote" *(Sychium edule)*.

Sweet Potato Farming System

Cropping Calendar

Crop rotation and intercropping are practiced even today. Sweetpotato and rice are the usual intercrops of banana. Rice followed by sweetpotato is the usual crop sequence.

Banana is planted in the months of April or May and harvested a year after. Rice as an intercrop is planted in June and is harvested either in October or November. After rice is harvested, sweetpotato is planted in December or January and harvested in May or June.

In lower Taloy Sur where there are more irrigated lands and less "uma", sweetpotato can be grown in patches for a maximum of three years. On the other hand, in Taloy Norte where there are more rainfed "uma", sweetpotato can be cultivated in the field only for a year. Sometimes, pigeon pea and taro are planted simultaneously with sweetpotato, with the former harvested a year after. Taro is usually grown along waterways and harvested four to five months later. These practices are done up to the present in small parcels of sweetpotato fields (Figure 7).

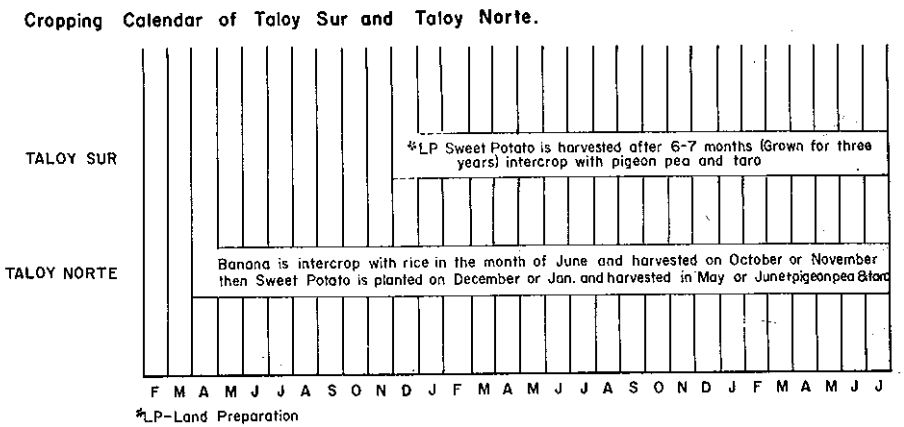


Fig. 7. Cropping calendar of Tuba, Benguet.

Land Preparation

Common in a subsistence economy is swidden farming. Unlike in Bakun and Kapangan where cutting of vegetation is first done prior to burning, swiddeners of Taloy do otherwise. They burn the area from the top most part of the slope going down. According to them, this minimizes the burning of the entire forest. The unburned vegetations are cut, gathered, and piled for burning which is referred to as "ensul". The entire process is done manually by a household with the aid of farm implements such as "bareta" and an ax used primarily for clearing, and with "sanggap" used for planting, harvesting, and weeding. If a wider area is to be prepared, "aduyon" (cooperative work) is practiced. The person soliciting "aduyon" labor is tasked to prepare a meal, usually lunch, for everyone. Though it is not a must for the individual who requested labor for assistance to do the same for his neighbor Filipino values especially the idea of "utang na loob" (indebtedness), imply the need for some form of reciprocity.

The traditional way of opening and preparing an "uma" has not changed even up to the present. It is however, claimed that land preparation is no longer as tedious as before because there are no longer hardwood trees. Besides, "chayote" which now occupies most of the sweetpotato area does not require thorough cleaning because it is grown entirely on raised horizontal trellises.

Varieties

The oldest varieties grown by farmers are locally known as "puti-an", "kalbo-oy", "girayan", "samping", and "sampero". The "puti-an" was claimed to have been cultivated even before the 1940's. This used to be a staple food, with the shoots used as viand. The variety was displaced by "girayan" and "kalbo-oy" which the people preferred because these were "nabukag" (mealy). Other varieties followed like "samping" and "sampero". Of the two, "samping" was preferred because of its mealy taste and golden yellow flesh. It is believed that sweetpotato with yellowish flesh has a higher nutritive value. The only traditional variety currently grown is "kalbo-oy". However, this is interpersed with the new ones such as "kawitan", "kapangan", or "kiangan" which were introduced in the late 70's (Table 3).

Two of the lately introduced varieties, as their names imply, originated from Kapangan and Kiangan.

Table 3. Sweetpotato varieties in Tuba

VARIETIES	CHARACTERISTICS
A. "Traditional" varieties	
1. "puti-an"	- leaves are wide and round shape - stem is slightly violet to green in color - roots are big and elongated - skin and flesh are white - shoots are good for viand - "puti-an" is a vernacular term meaning white
2. "kalbo-oy"	- the only variety still in existence up to the present - leaves have rounded apex, green midrib and petiole - shoots are non-hairy - high vegetable growth and low root production - skin and flesh are white - roots when cooked are mealy
3. "girayan"	- shoots are slightly violet while matured leaves are green - leaves are elongated with five indentations - stem is slightly violet to green in color and is usually very hairy ("nabudo") - roots are red, flesh is slightly yellow to white - roots when cooked are mealy and sweet - could be grown in the "uma" for three years
4. "samping"	- shoots are slightly violet while matured leaves are green - leaves are indented stem is red - skin and flesh are golden yellow - considered as the best variety because of its mealy and sweet - could be grown in the "uma" for three years
5. "sampero"	- shoots are slightly violet while matured leaves are green - leaves are rounded in shape - skin is red - flesh is white - high yielding but tasteless when cooked

Table 3. Continued...

VARIETIES	CHARACTERISTICS
B. Varieties introduced since the late 70's	
1. "kawitan"	- leaves are rounded, shoots are violet and slightly violet when matured - young stem is slightly violet but as it matures, its color darkens - skin is red, flesh is white - shoots are good for viand - matures in three months
2. "kiangan"	- shoots are violet while matured - leaves are green; underneath is violet - leaves have five indentations - stem is hairy - skin is violet - flesh is a mixture of white and violet - when cooked, it is moist and sweet - matures in three months - high yielding with one root having a maximum weight of 600 grams; average weight/tuber is 300 to 400 grams - believed to have originated from Kiangan, Ifugao
3. "pagsay" or "kapangan"	- leaves are rounded, shoots are slightly violet while matured - leaves are green - stem is slightly violet and smooth - believed to have originated from Kapangan, Benguet

Planting Materials and Planting Methods

Cuttings are locally known as "pagad". These are taken from the old plants and stored in moist areas for at least three days to initiate rooting. The length of one cutting is approximately 30 centimeters.

Like in Bakun and Kapangan, the usual practice is to put two to three cuttings side by side in one hill with a depth of about 6.5 centimeters. The distance between hills is approximately 30-45 centimeters. However, in most areas visited, planting is more dense. The distance between hills is around 30 centimeters, on the average. It was observed by farmers that increased density usually yields smaller roots. The reason behind the change in planting density is the very limited space devoted to the crop. Mostly, sweetpotato is planted under "chayote" trellises while the latter has not fully grown (Figure 8)

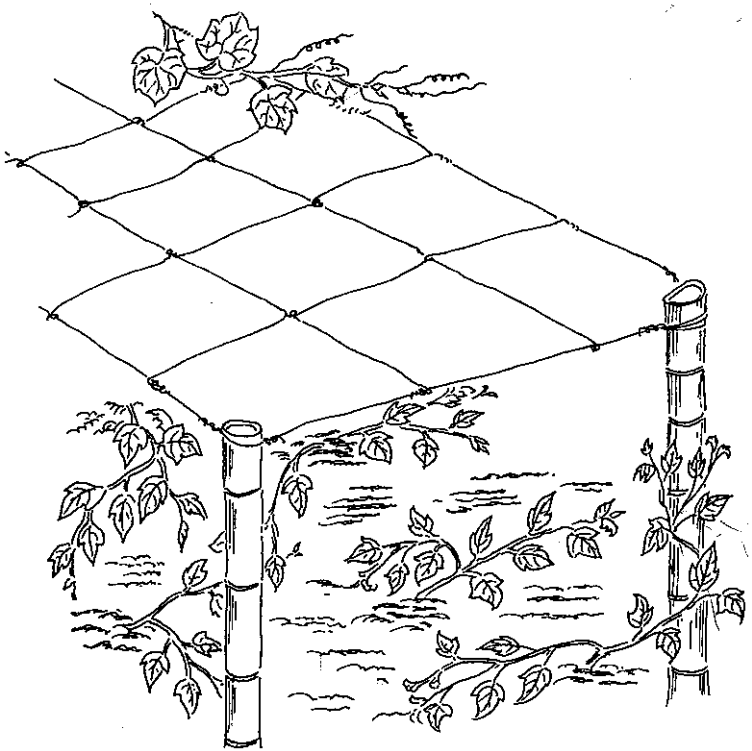


Fig. 8. Sweet potato grown under *Sychium edule.*

Pests and Diseases

The most common pests observed are "bakbakes" that feeds on leaves, "imok", a mosquito-like insect that feeds on leaves and damages the skin of the roots, "utot" (rat) that feeds on leaves and roots, and "tupling", a bird that scratches the soil and eats the roots. This bird usually feeds during early morning.

The only disease reported by farmers is "butong" which is characterized by browning of the flesh.

It was claimed by most respondents that infestation by the abovementioned pests and rats and affliction of "butong" disease occur particularly when there is continuous rain/shower for about a week followed by a dry week.

"Imok" is controlled by removing the matured leaves where it thrives. Farmers claimed to have never attempted to kill rats because of a belief that rats may retaliate by destroying the "uma" when harmed. They added that in the 40's, rodents were not a problem. The advent of intensive vegetable gardening coupled with the heavy use of fertilizers and pesticides have brought unfamiliar pests and diseases.

Harvesting and Post Production Practices

Sweetpotato is harvested at least two to three times annually. Farmers claimed the frequency of harvesting is dependent on the variety grown. Some varieties, especially when properly managed, can be harvested continuously for three years, though this is no longer common. Most of the sweetpotato crop today has a life span of one year at the most. Initial harvesting is done after 5 to 6 months and the succeeding ones take place after three months. It was reported that the third harvest usually yields smaller roots.

"So-an" (pointed iron bar for harvesting) or "chup-chup" (Ibaloi term for so-an) is the most popular tool used in harvesting sweetpotato roots. For hauling, the "kayabang" is used by women while the "batulang" by men. It is interesting to note that farm implements are designed to suit the users.

Prior to the 1940's, sweetpotato was processed into "buku" as in Bakun and Kapangan. This could be the reason why only the old folks claimed to have heard of or tasted "buku". Even "sabeng" is also a thing of the past. The farmers' proximity to a big market center has changed some practices. The community folks of Tuba do not have to worry about processing or storing part of their produce because they have access to the market. Most of them opted for high value crops which could easily be marketed for cash.

In the early 60's, sweetpotato was sold at 0.15 centavos per kilogram and in the 70's, 0.50 per kilogram. At present, sweetpotato is hardly sold because it is mainly for home consumption. One respondent disclosed that with 100 square meters, the yield is just enough for home use.

MULTIPLE SWEETPOTATO FARMING SYSTEM IN A TRADITIONAL COMMUNITY: BONTOK, MOUNTAIN PROVINCE

Overview of the Farming System

Bayyo is a barangay of Bontok with a unique farming system dating back many years. It has a total land area of approximately 5,787 hectares described as moderately steep to very steep slope where permanent terraces and residential areas are located (Figure 9).

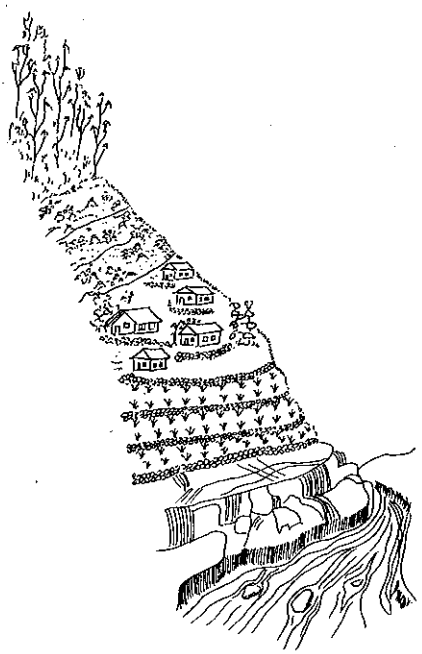


Fig. 9. Agroecological transect of Bayyo, Bontok, Mt. Province.

It has four land types: the pine and oak forest located on the top most portion of the transect, the teeming pinelands, the clustered residential units and the rice fields which are on the same elevation, and the river that supplies the rice fields with irrigation water all year round. Water for domestic use is likewise not a problem. There are two springs located at the highest peak of the mountain that provide potable water for the entire village and even for irrigation at times (HADP RRA Report, 1988).

Nowadays, seasonal migration is common in the village. Most of the work force of the community leave the village after planting or harvesting of rice to work in Baguio City or Quezon City. The older people who are left in the village are still strong and fit enough to do jobs like riprapping, carrying wooden slabs, road construction and repair, aside from farming. Rates for these jobs are set by the local officials. The men get P45 while the women receive P35. Both receive free lunch.

Sweetpotato Farming System

The "Payew" (Paddy) System

The rice fields located on the terraced areas provide the village its primary grain source. Sweetpotato, on the other hand, outyields rice but serves as an alternative food.

Rice is planted in January or February and harvested in July or August. Sweetpotato is planted in September or October immediately after rice. Sometimes leeks are planted along the borders in the same months. Harvesting of the sweetpotato and leeks is done at the same time (Figure 10). Most farmers plant sweetpotato as a monocrop.

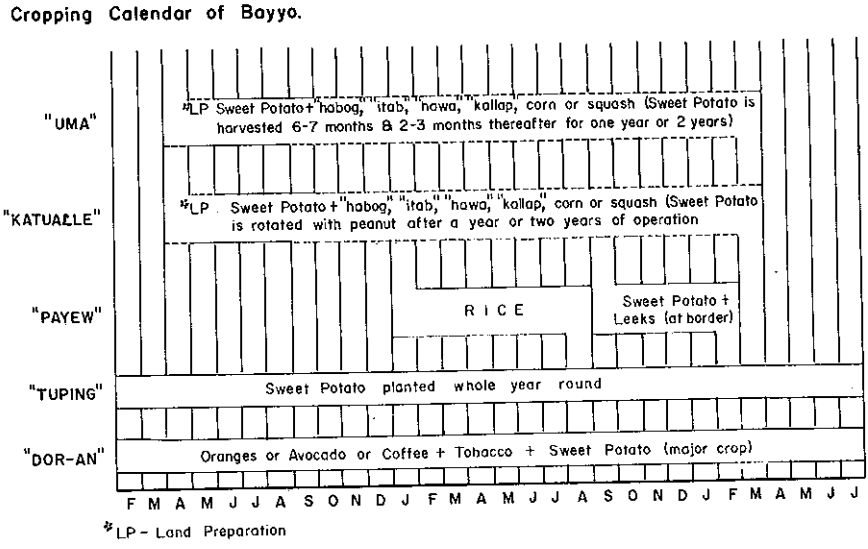


Fig. 10. Cropping calendar of Bayyo, Bontok, Mt. province.

Sweetpotato production in Bayyo is very different compared to Benguet where farmers only have swidden fields. Bayyo has four distinct sweetpotato farming systems. The "payew" is the most important because it is where the bulk of food supply is derived. Realizing the adverse effect of forest loss, swiddening is no longer widely practiced by the local folks.

Sweetpotato vines are as equally important as the roots. They are in demand the whole year round especially from January to March when crops from the "payew" are harvested. Bayyo farmers sell the vines at P2.00 to P3.00 per bundle in Bontok. Unsold vines are fed to the swine while some are left in the field to serve as green manure for the next crop. Others are utilized as planting material for the "dor-an" (household seedbank).

Gathering sweetpotato tops for viand is only done on the third month when the plant has fully rooted and has profuse vegetation.

Land Preparation. Land preparation starts immediately after rice is harvested. Plots or what they call "baliling" or "faliling" are made usually in August. These are very important to prevent waterlogging of sweetpotato planted in water-soaked paddies or during heavy rains. The "baliling" also hastens root formation and allows easier harvesting (Figure 11).

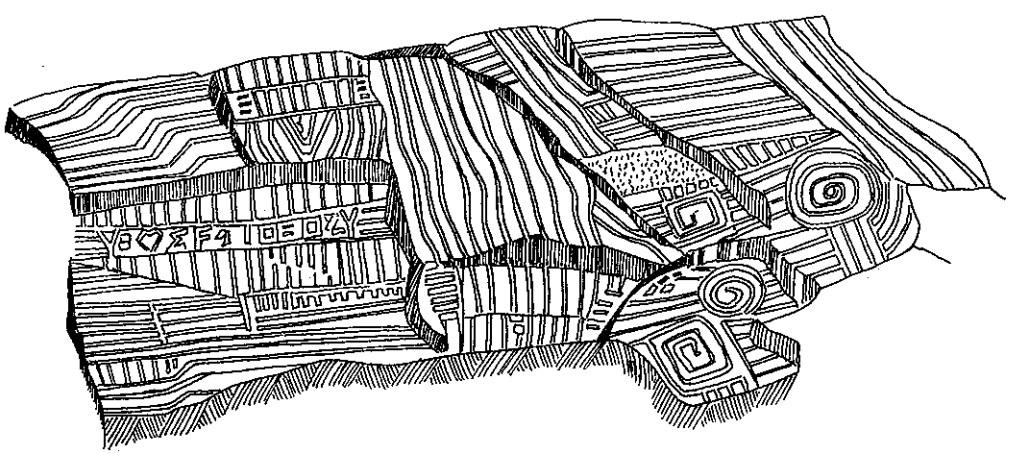


Fig. 11. Different formation of plots called "baliling" or "faliling".

The practice of plowing their plots into different forms and in raised beds involves thorough cultivation which is done to condition the soil for the next crop, i.e., sweetpotato.

It is in Bayyo where differently formed plots are made such as circles, letters, and triangles. The reason for this practice is still not clear, though several have been suggested: the plots were made by the ancestors as an expression of one's feelings for somebody; as a better way of cultivating the soil (each year a different pattern is made to improve soil structure); as an easier way of construction (through this means they are able to avoid obstructions such as big stones and rocks) compared with the conventional way of having horizontal or vertical plot formation. It was learned during the interview that the experts do the circles while beginners do the triangles and letter form. In addition, young male farmers build plots bearing the initials of the woman with whom they have a special interest.

Varieties. Varieties planted sometimes depend on the farming system. The variety locally called "akong" is best suited for the "payew". It has been tried in the "uma" but was unproductive. "Akong" has red skin, yellow flesh, and matures in three to four months.

According to most respondents, "akong" is preferred by older women and the younger people because of its sweet taste when cooked after storage.

Others like "tukong" and "ingetanget" can also be grown in the "payew" as well as in the "uma". If "akong" is the variety desired by the women and the younger people "tukong" is the variety favored by older men because it is not too sweet. Just like in other sweetpotato growing areas in the study, it was noted that names of local varieties depend on the place of origin and/or its physical appearance.

Planting Materials. Bayyo farmers plant cuttings (a foot long) immediately, leaving only about 3 to 4 leaves at the tips. The detached leaves are utilized as feed for swine.

Farmers plant a single cutting in one hill in a slanting position with a distance of about 30 centimeters. The cuttings are taken from their "dor-an".

Fertilizer Management. Fertilizing through green manuring is still practiced. Sunflower leaves are placed at the base of the sweetpotato. This is done after all the cuttings are planted. Farmers also believe that hog waste called "pilloy' from the pig sty applied when rice is planted can still fertilize the sweetpotato.

Weeding. Unlike the "dor-an' which is cleaned always, the "payew" is weeded only twice. The first weeding usually takes place two months after planting. It is a common practice once weeds are abundant to hill up immediately using the "dap-dap". Instead of eliminating the weeds, these are covered with earth. The weeds serve as additional green manure for the sweetpotato. The second weeding is done one month before harvesting.

Pests and Diseases. Low production in the area was reported to be caused primarily by adverse weather conditions which increase the occurrence of pests and diseases. Some farmers reported using minimal spraying while others apply nothing. Some pests are manually exterminated. Major pests of sweetpotato include rodents, "gorgor" (tiny flies), sweetpotato weevil, and "pinag-pag-ong" (lady bugs). Rodents are claimed to be the worst problem because they attack the fields and even storage houses during the rainy season. Use of rat poison by some farmers has not significantly controlled the problem. Damaged leaves caused by "gorgor" are removed and weevils are sprayed occasionally. The only major disease causing damage to sweetpotato is leaf scab.

Even with the advent of modern techniques, farmers in the area still practice traditional rituals as a way to control pests and diseases. One practice involves lighting a fire in the field, after which a roasted chicken is brought to the field. This is followed by prayers recited by an old chieftain. According to the farmers, the practice enhances plant vigor and growth.

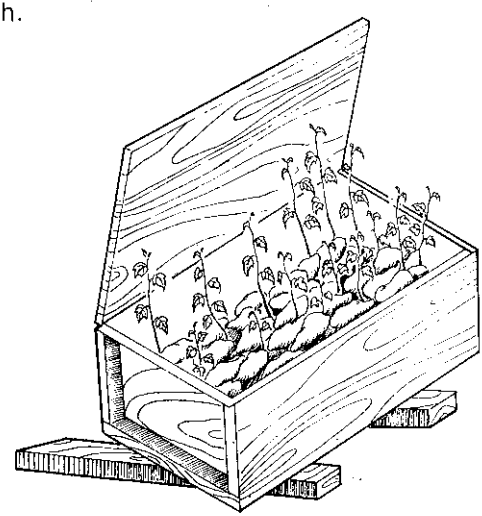


Fig. 12. The "pukok" sweetpotato storage

Harvesting. As mentioned earlier, harvesting in the "payew" is done once. Roots are gathered, sorted (damaged roots are separated), and stored immediately in the "pukok" (Figure 12). In cases when there is bountiful harvest, some are stored in the "allang" (Figure 13).

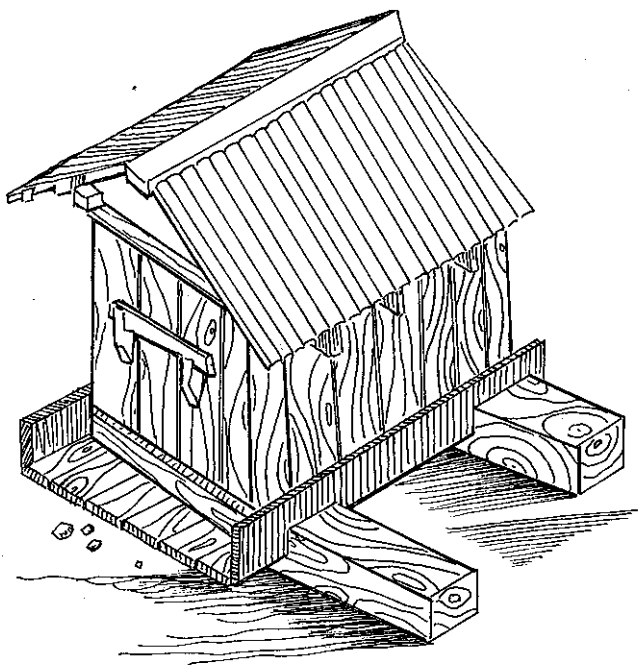


Fig. 13. The "allang" rice storage

The "Dor-an" (Household Seedbank) System

In this system, the crop is planted in the yard for two reasons. One is to supply the backyard swine's feed requirement. There exists a symbiotic relationship between the swine and the backyard farm, as explained by Yen (1964). He said that "backyard swine provide manure, the crops provide food for the household, and the residues including human waste go back to the pig" (Figure 14).

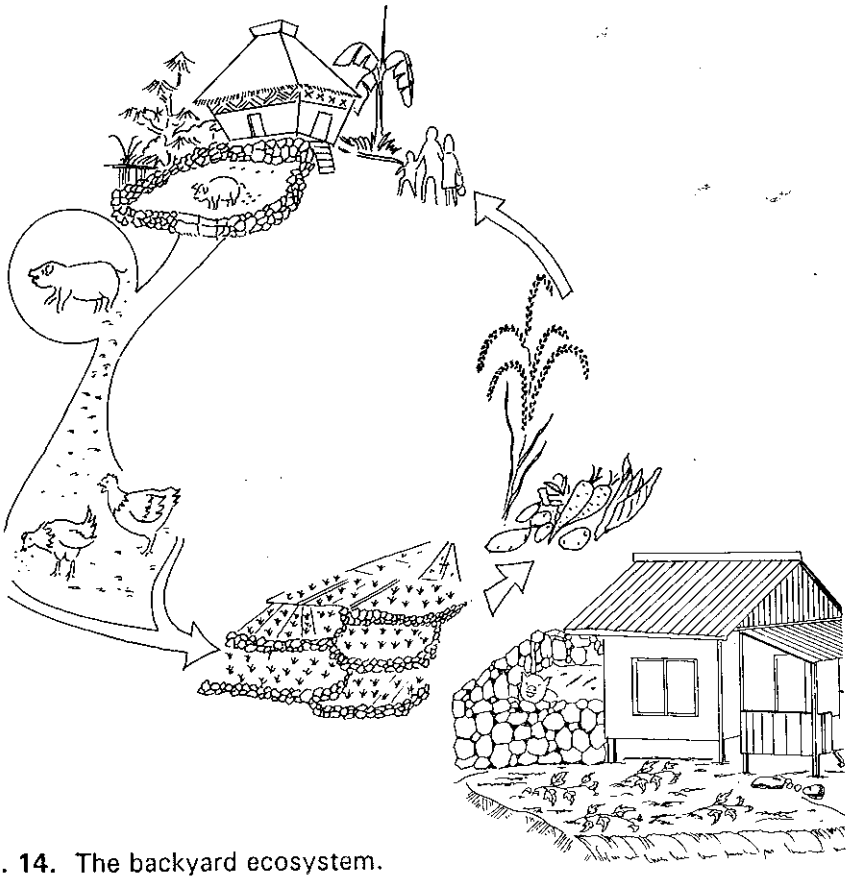


Fig. 14. The backyard ecosystem.

Apart from being used as a source of feed, the "dor-an" serves as a seedbank. For most, the seedbank is where they preserve their special varieties in time for the "payew" and "uma" planting season. Sometimes too, whatever varieties they have at their disposal, these are grown in the seedbank.

Townfolks gather tops for viand from the "dor-an" at the higher slopes where chickens and dogs do not stray.

The "uma" (Swidden Field) and "Katualle" (Permanent Swidden Field) Systems

Swidden cultivation also known as "uma" is the most common way of land clearing in sloping areas beyond 18 degrees. Most households engaged in this type of farming system have more than one site under cultivation as a form of food insurance. The average size of a single size is 0.3 hectare. Some farmers have more than one hectare but not contiguous. The closest plots are a few meters from the settlement and the farthest about five kilometers.

The "uma" in Bayyo is classified into two. The first is called "uma", a patch of cultivated land with no improvements. The second is called "katualle", which is cultivated yearly and sometimes terraced or fenced.

In the first type of "uma", it is cleared in April and sweetpotato is planted immediately. Staggered harvesting is practiced. It is primed three times a year at two to three months interval. Newly-planted cuttings of sweetpotato are mulched with sunflower leaves which are abundant in the area. Sweetpotato could grow in the "uma" for one to two years before it is to fallow for about five years or more.

In the past, the most common intercrop of sweetpotato is "habog" (millet). Today, farmers use green legumes ("itab", "hawe", and "kallap"), corn or squash.

Yield of sweetpotato in the "uma' is low according to local people. The area is usually the source of planting materials for the "payew" and feed for swine.

In the "katualle", clearing and planting are done at the same time with that of the "uma". However, crop rotation is practiced. Sweetpotato is usually rotated with peanut.

The most common sweetpotato varieties for the "uma" and the "katualle" are "ginumarab", "kalbo-oy", "tukong", "ingetanget", and "bukkag". The latter is not suited in other areas, only in the "uma" and the "katualle".

The "tuping" (Stone Walls) System

The crevices of the stone walls of the "payew" and the "dorban" are planted with sweetpotato (Figure 15). Vines grown in this niche are used as animal feed and planting materials occasionally. According to the farmers, this is one way of maximizing space utilization and as an excellent vegetable cover to prevent the growth of weeds where rodents hide. Sweetpotato grown in the stone walls during the rice growing season enables the farmers to sustain the pig's feed requirement. At times, it can also become as an occasional source of cash among the elderly women.

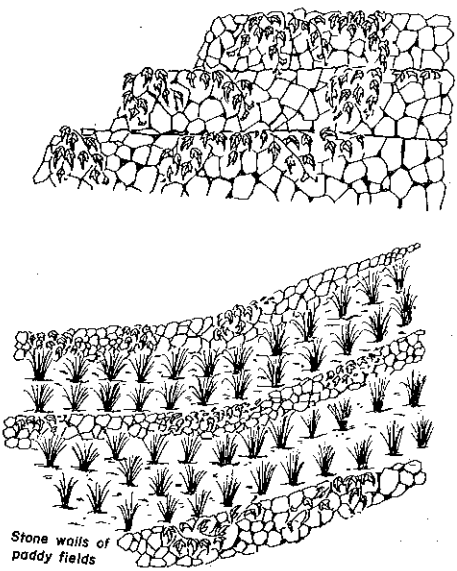


Fig. 15. The "tuping" sweet potato system.

Post-Production Practices

Harvesting. Harvesting is done by experienced farmers, mostly the older folks and those that have actually done this type of work. Sweetpotato in the "payew" is harvested with the use of "eswang" (a spading fork widely adapted and is used in all farming operations).

Another newly introduced method of harvesting sweetpotato in the "payew" is the use of a carabao-drawn plough. It speeds up harvesting causing less injured roots than when traditional tools are used.

Harvesting is usually done by the women as men and young adult children frequently seek seasonal jobs outside the community . Even ploughing is also done by the women. In hauling sweetpotato roots from the fields, men use the "barakat" and the "gimata" while the women use the "tad-ag".

Handling and Storage. To most Bayyo farmers, sweetpotato is an important substitute to rice especially in times of food shortages. Respondents claimed that sweetpotato was the only survival crop during the Second World War when all the grain reserves were pillaged by the Japanese Army. Such a tragic experience inculcated the value of storing food and the practice of storing food by the community continues into the present.

Most Bayyo farmers store sweetpotato both for animal and human consumption. Occasionally, they sell sweetpotatoes when there is a bountiful harvest. This happens especially during December to January.

Processing. It is only when damaged roots from the storage containers that "bukor" is made. Sweetpotatoes are peeled, thinly sliced with a homemade chipper, dried-up on flat iron sheets for at least one week, pounded and stored in tin cans. This preparation is usually mixed with sugar or ground peanuts, and wrapped with banana or sugarcane leaves and boiled.

Aside from making "bukor", another post-harvest practice is making "sabeng". This is made by first fermenting the rice using homemade yeast. The womenfolk make yeast by pounding glutinous rice "diket" and sugarcane and form these into cubes or rectangular shapes.

After one week, other ingredients like bone left-overs of either animal or fish, and cooked sweetpotato are placed in the jar together with cooled boiled water. After placing all these, the jar is sealed and after three days, the mixture could be used as sauce for fish, meat, and vegetables.

Respondents said that "sabeng" is an invigorating drink when one is tired. It also increases mammary secretion among nursing mothers. Almost all households have "sabeng".

SUMMARY AND CONCLUSION

In the uplands of Northern Philippines, sweetpotatoes are grown mainly for subsistence and especially as a supplement to rice, as a seasonable staple and/or as feed for swine.

Production of the crop does not vary significantly except in Bayyo, Mountain Province, where sweetpotato plays key role in the farming systems (Table 4). The crop has found niches even in the unfavorable parts of the area. Farmers have even adapted a distinct practice for growing sweetpotato called the "baliling" or "faliling" where cuttings are planted in raised beds in a concentric manner or other patterns like the owner's initials.

One interesting finding is that sweetpotato is a woman's crop. Except for fencing the "uma" which is commonly done by men, all farming operations are performed by women (wives/elders). These include planting, weeding, harvesting, hauling as well as processing of harvests. Women know more than men when queried about the crop.

Table 4. Summary of findings in the four sites.

PARTICULARS	BAKUN	KAPANGAN	TUBA	BONTOK
A. Land Preparation and Planting	Swiddening called "uma" Land preparation is in May or June	Swiddening called "uma" Land clearing/planting is in December to January	Swiddening called "uma Taloy Sur - Land preparation/ planting is in December to January Taloy Norte - Land preparation/ planting is in November to December	Payew (paddy) - land preparation/planting is in August to September "Baliling" - raised beds are made/done by men Uma (swidden) - land preparation/planting is in
	Vegetation is cut and burned (done by men)	Vegetation is cut and burned (done by men)	Vegetation is cut and burned (done by men)	April to May (done by women) Katualle (permanent swidden) - planting date same with "uma" (done by women) Dor-an (homegarden) - planting is done anytime (done by women)
B. Varieties 1. Number of varieties	One traditional variety Five new varieties	Eight varieties are	Four varieties are widely grown	Payew - three varieties are grown with "akong" (traditional variety) highly preferred Uma - four varieties are widely grown Katualle - any available variety Dor-an any available variety Special varieties like "akong" and "tukong" are kept in the dor-an
	Two or more varieties are grown in one area	Three to five varieties are planted in one area	Two or more varieties are in one area	Two or more varieties are grown in the payew, uma, and katualle
2. Choice of varieties to be grown		Done by women	Done by women	Done by women
3. Nomenclature	Varieties are often named after the place of origin and based on special charcteristics	Varieties are often named after the place of origin and based on special characteristics	Varieties are often named after the place of origin and based on special characteristics	Varieties are often named after the place of origin and based on special characteristics
C. Planting Material and Method of Planting	Cuttings are taken from old plants and stored in moist areas for one week	Cuttings are stored in moist or shaded areas for three days	Cuttings are from old vines stored in moist areas for three years	Cuttings about one foot long leaving 3 to 4 at the tips The source can be from any of Special varieties are from the dor-an
	Old vines (healthy portions are covered with soil	Size of cuttings depends upon what is available	Grown under chayote while it has not fully grown	

PARTICULARS	BAKUN	KAPANGAN	TUBA	BONTOK
	Two to three cuttings per bill in a slanting position	Two to three cuttings per bill in a slanting position	Two to three cuttings per bill in a slanting position	One cutting per bill in a slanting position
D. Resource Management	Fallowing, intercropping with leguminous crops Big trees are trimmed and can served as trellises for legumes Soil conservation - border canals or embankments are made	Fallowing, intercropping with leguminous crops Big trees are trimmed and can served as trellises for legumes Soil conservation - border canals or embankments are made	Fallowing, intercropping with leguminous crops Big trees are trimmed and can served as trellises for legumes Soil conservation - border canals or embankments are made	Fallowing only for the uma Intercropping with leguminous crops Crop rotation Soil conservation - border canals and ripraps Soil fertility - green manuring using sunflower and swine manure
			Grown under chayote while it has not fully grown	All available spaces are planted with sweet potato
	Rat control - use of pesticides predators			Rat control - use of pesticides and keep the surroundings clean
E. Harvesting	Priming - initial priming is done 5 to 6 months after planting	Priming - initial priming is done 6 to 7 months after planting	Priming is three times per year Sweet potato grown under chayote are harvested only once	Payew- done only once using handmade tools or carabao-drawn plough Uma - staggered harvesting Katualle - staggered harvesting Tuping - major source of vines for swine, harvesting can be continuous
	Homemade tools are used Done by women	Homemade tools are used Done by women	Homemade tools are used Done by women	Homemade tools are used Done by women
F. Post Production and Utilization	Sorting (segregating damaged roots)	Roots are exposed	Roots are washed then sold in Baguio City or along the national road	Payew - sorting (segregating damaged roots), then immediately stored in pukok or allang
Food Preparation - Roots	Washing of roots Boiling Broth after boiling called "sabeng" is fermented as an alcoholic drink; vinegar, and cure for stomach disorders	Sorting (segregating damaged Boiling Broth called "tengba" is fermented as an alcoholic drink (fermentation is one week to one year), vinegar (at 7 to 15 days) and as cure for stomach disorders, minor burns and hang-over	Boiling	Boiling Sabeng is differently prepared - several ingredients are added like boiled sweet potato, bones of pork and cassava
	Dried chips called "buku", pounded and mixed with glutinous rice or sugar	Dried chips called "buku", pounded and mixed with glutinous rice, sugar, or peanuts		"Bukor" - dried chips are made only when there are damaged roots from the storage containers
-Shoots	Non-hairy shoots are preferred	Non-hairy shoots are preferred	Non-hairy shoots are preferred	Non-hairy shoots which are taken from uma, katualle and occasionally from payew

Table 5. Assessment of research recommendations.

	PARTICULARS	PRODUCTIVITY	STABILITY	SUSTAINABILITY	EQUITABILITY	COST	TIME HORIZON	FEASIBILITY	PRIORITY
1	Varietal trial of sweet potato varieties considered best by farmers of another locale and institutions like NPRCRTC.	HIGH	MEDIUM	MEDIUM	HIGH	MEDIUM	HIGH	HIGH	2
2	Compost making using trichoderma	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	5
3	Biological control of pest and diseases.	HIGH	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW	LOW	6
4	Fertilizer trial using organic material	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	
5	Assessment of the nutritional value content of "sabeng"	MEDIUM	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	HIGH	4
6	Assessment of the storability of "buku"	MEDIUM	HIGH	HIGH	HIGH	MEDIUM	LOW	HIGH	3

Women are highly visible in the "uma", either in harvesting the vines, cleaning/weeding, or planting. In the dialogue-forum where equal number of male and female farmers were invited, 99% of the women participated.

The cultivation of sweetpotato is a traditional, indigenous activity. Most production and utilization practices continue in the traditional way, with the exception of the adoption of new varieties, which is a recent practice. Hence, before one attempts to modify the practices of the sweetpotato subsystem (i.e., increasing productivity), it is suggested to elicit farmers' indigenous knowledge and perspective which are indispensable inputs in the design of a program aimed at finding solutions to problems and needs. The study shows that there are numerous farmers' know-how on sweetpotato which can be further developed by R & D institutions.

RECOMMENDATIONS

The dialogue-forum held after the research was intended to gather feedback on the research results from policymakers and extensionists and to validate the findings with the farmers. It also aimed to identify researchable areas suggested by the research findings.

The recommendations made were the results of the discussions during the panel, plenary session, and tasking and future planning. Recommendations are ranked according to priorities for implementation. The ranking was based on the agro-ecosystems matrix which scores according to the following criteria: productivity, stability, sustainability and social equity. The matrix was extended to economic, social, and technical feasibility and time horizon for implementation (Table 5).

Moreover, ranking was also based on the following considerations (Binder et.al., 1989):

* Priority should be given to the improvement of potential indigenous practices rather than external factors.

* Proposals should benefit resource-poor farmers, the main target of this undertaking.

* Proposals should be appropriate to already existing structures (research and administration) taking into consideration their limited capacities.

The recommendations are mostly researchable. Most of these can be done at the farmers' level.

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