MECHANIZING PHILIPPINE AGRICULTURE

(*Continuation*)

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Mechanization as applied to land preparation [1] shows how tractors and modern steel plows and harrows may be used to save time and to reduce tillage costs. In this article, the effects of mechanization on other farm operations are briefly discussed.

PLANTERS AND PLANTING

Rice, corn, sugar cane, tobacco, cassava, camotes, peanuts, cowpeas, and soybeans are generally planted by hand. Rice may be transplanted, broadcast, or sown. The proper spacing and setting of certain number of seeds or of seedlings in a hill depend largely on the skill of the men and women who are hired during the planting season.

In lowland rice field, some 20 to 25 man-hours are spent per hectare to pull, bundle, top, and transport the seedlings from the seedbed to the paddies. Planting which requires from 60 to 70 man-hours per hectare, is facilitated by hiring gang of planters varying from five to ten persons per paddy. It takes about 20 man-hours to furrow, from 3 to 5 man-hours to broadcast, and from 30 to 40 man-hours to cover a hectare of upland rice field. In "bakal" system where skillful planters dig first a hole by a pole, then plant and cover, greater number of man-hours than the transplanting system are required to plant a hectare.

A mechanized unit that may be used to replace the transplanting method has not as yet appeared in the market. Special devices which will enable the prime mover and the planter to work efficiently on a very well puddled mud to a depth of not less than 15 centimeters will be needed for this purpose. In upland fields, no difficulty will be found in the use of seeders, of transplanters, or of any power driven planting machinery to replace the animal and hand operated devices.

Mechanized seeding machinery accomplish the work of distributing the seeds uniformly, planting them at uniform rate and depth, and covering them. Some devices are provided with attachment to spread controlled amount of fertilizers at some proper distances from the seeds. To suit various farm conditions, mechanical planters are made available either as walking or as riding machinery. The walking types include devices that can be pulled by single, double, or by pairs of teams of horses, carabaos, and bullocks. The tractor-driven drills, planters, and seeders vary in sizes depending upon the number of rows that can be planted in one operation.

Of all the upland crops, sugar cane needs the greatest amount of work for planting. The land which has previously been plowed and harrowed from three to five times is next furrowed. It requires at least two plowings using special wooden moldboard that can throw the dirt up on both sides of the harrow, to prepare a satisfactory furrow bed of about 20 to 30 centimeters deeps. From 60 to 80 man-and-animal hours are needed in this preparation. Hauling of the cut points requires from 60 to 65 and planting from 75 to 85 man-animal hours per hectare. The cost of harrowing, hauling of points, and of planting per hectare of cane field in the College of Agriculture using man-and-animal labor, was computed to be from ₱20 to ₱25. A mechanized furrower and planter with fertilizer attachment can plant a hectare for less than 5 hours at a cost not exceeding ₱6.00.

The cost of furrowing, broadcasting, and covering of seeds per hectare of upland rice was estimated to be about ₱6.00. The use of a tractor-driven grain drill which planted eighteen rows at a time in a 3-meter cut required only about 2 hours to plant a hectare at a cost not exceeding ₱3.00.

Corn requires from 15 to 20 man-animal hours for furrowing and about 20 man-hours for planting at a cost of about ₱3 to ₱4 per hectare. With a single-row planter furrowing and planting requires about 35 to 40 man-animal hours. Tractor drawn three-row planter requires only 3 to 4 hours at a cost not exceeding ₱4.00.

Tobacco needs about 60 man-animal hours for furrowing at a cost between ₱5.00 and ₱6.00 per hectare. Planting requires from 130 to 140 man-hours at about P15.00 per hectare. With mechanically driven

tobacco transplanter, the time may be reduced considerably at a slightly less cost.

CULTIVATORS AND CULTIVATION

Cultivation makes it possible to reduce the soil particles to a fine state thus regulating the water-holding capacity of the soil. By pulverizing the soil, aeration, is enhanced, soil temperature is modified, and plant food is freed. Weeds are destroyed, the depth of the seed bed is increased, and a certain means of adding green manures is accomplished by proper cultivation. The importance of using efficient cultivators within a certain specified time cannot thus be over-emphasized.

In lowland rice fields weeding is generally done by hand or by the use of a metal pointed weeder which cuts or digs the weeds. When properly done very efficient work is accomplished with this tool. Considerable man-hours are however, spent in very weedy areas. A mechanical weeder that can be adapted to a very wet soil offers an important problem for investigation towards the mechanization of lowland rice fields.

In producing upland rice no less than 150 man-hours is needed to weed a hectare of land. What modern cultivators of the walking or traction type can do in upland rice fields has yet to be investigated.

Fields grown to sugar cane, corn, cassava, camotes, and soybeans are generally cultivated by means of the native plow. In the College of Agriculture some 270 to 300 man-and-animal hours are needed at an expense of from ₱25 to ₱30 to hill-up, to off bar, and to hill-up again a hectare of cane field. Corn requires from 50 to 60 man-and-animal hours at a cost of not less than ₱5 to cultivate, one hectare of land. With tractor drawn cultivator, the time required was only from 4 to 5 hours at an expense not exceeding ₱4.00.

Modern cultivators vary from one-animal cultivators to multiple-row tractor-drawn types with either pegtooth or shovel-tooth points. Different attachments are used to make soil pulverization easy and to kill weeds effectively. Some could be raised or lowered depending upon the size of the plants grown.

HARVESTERS AND HARVESTING

Hand and hand-operated tools are principally used to harvest most of the Philippine field crops. Rice is cut by several types of hand cutters, corn is plucked by hand, sugar cane is cut by bolos, and root crops are dug either by mattocks or shovels, or are plowed up. Mechanized harvesters have been developed to make the work less laborious, to save time, to economize, and to combine several harvesting jobs.

Harvesting and threshing of rice requires from 200 to 250 man-hours per hectare. Harvesting corn requires from 170 to 180 man-hours, sugar cane topping 120 to 125 hours, sugar cane cutting 180 to 190 hours and cassava over 700 man-hours by using mattock-axe and 190 to 200 man-animal hours by plowing. Tests made in the College of Agriculture showed that a rice mechanical harvester and binder hitched to a team of three animals cut approximately 2.5 hectares within eight hours. Plowing up cassava roots using tractor required about 50 man-hours and 16-tractor-hours to harvest one hectare.

The writer's experience in a California rice field showed that grain binders with at least a 7-foot cut pushed by a tractor could easily harvest 10 hectares per day. Large combined harvesters and threshers were noted to be capable of harvesting no less than 35 hectares per day.

The cost of harvesting rice in the College of Agriculture by hand cutters is estimated to be between ₱20 to ₱25 per hectare. Harvesting corn costs from ₱15 to ₱20; sugar cane, ₱10 to P15 for topping and ₱18 to P20 for cutting; and cassava about ₱70 by using mattock-axe and P20 by plowing. The estimated cost with the use of animal-drawn rice binder was not higher than ₱4 per hectare. The writer estimates the cost of rice harvesting by tractor and binder to be not more than ₱2.00 per hectare.

THRESHERS AND THRESHING

The methods employed to thresh rice grains in the Philippines are by trampling with human feet, or with animals, by "hampas," by flail, and by power-driven threshing machines. The rice bundles are first either shocked or stacked and then laid on bamboo slatted platform or on the ground usually lined with carabao dung, to be trampled by feet. Wind is utilized to blow the chaff away. "Hampas" system requires the use of wooden sticks to serve as handle for hitting the bundled rice straw against a rock. In the "flail" system, the rice bundles are laid on the ground and are hit by a revolving bamboo stick which is freely fastened to another pole by a short peg. The separated grains are then winnowed.

Tractor-driven rice threshers are used extensively on the big rice farms in the Philippines. The machines worked so well in loosening the grains from the straw in separating the chaff from the grains, and in cleanning the palay, that many farmers find its use better than the hand or foot operated threshers. Not only are the grains shelled out of heads without cracking the kernels but the weedseeds are sifted out and only clean grains are obtained.

Studies made in the College of Agriculture gave approximately 115 man-hours as the labor requirement in threshing rice harvest from one hectare of land by trampling by feet, 80 man-animal hours by trampling by driven animals, 81 man-hours by flail, 63 man-hours by "Hampas" and only 8- man hours and about 1 tractor-hour by power driven threshing machine.

MISCELLANEOUS MACHINERY

Hullers and polishers. Rice hullers, whether of the locally so-called "kiskisan or "cono" type have met with great success and are thus used in nearly all rice-growing regions of the Philippines. Except in small barrios or in mountainous regions where the mortar pestle, and the "gilingan" are found to the great advantage of individual farmers, modern hullers and polishers are meeting with a great deal of favor. It is not uncommon to see two or three hullers in a certain town that are operated by some kind of power units. It is the practice to carry the palay to town and pay either by cash or by certain percentage of the rice per cavan or per ganta for having it hulled.

Pumping machinery. Some farms or a group of farmers frequently find it to their advantage to irrigate their farm from small streams either by the use of temporary dams or by pumping. The common use of small power units, as gasoline or kerosene engines from 1.5 to 10 horsepower has made the use of centrifugal pumps not only desirable but profitable.

Special machinery. Individual farmers also find it of great advantage to mill his canes to make "panocha," to grind some of his agricultural products, to pull stumps, to cut wood, and to strip his abaca or ramie. Possessing a power unit similar to the one used for pumping machinery becomes desirable for the proper handling of these jobs.

ADVANTAGE OF MECHANIZATION

Very slow progress has been made in farm methods and machines here in the Philippines. Our farmers, have not used extensively power-driven machines for tilling the soil.

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Mechanizing...

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The products of the farm are not yet sufficient to feed the ever-growing inhabitants.

Modern farm motors and power machinery have the definite advantage of giving better quality of work and of doing the job in much less time then by the man and animal labor. By increasing the area under cultivation with the use of mechanized units, it is possible to supply food to our millions of population plus food for additional millions outside of the Philippines.

The use of carabaos and of bullocks as the main source of native power has the disadvantage of being slow, weak, and subject to attack of pests and diseases. With mechanized units unnecessary delays can be minimized or ultimately cut out, and land preparation, planting, cultivating, harvesting, threshing, preparation of finished agricultural products, and delivery to market will all be done on time.

Although estimates made in the College of Agriculture always indicate better economy with the use of modern implements it is difficult to figure comparative costs owing to different rates of local wages and of unfixed prices of motors and machinery. In large sugar centrals and in Koronadal Valley where power-driven machinery have been found to be an absolute necessity and where no other tools are used or called upon to do various heavy farm work for so many days in the year, the utilization of modern farm mechanical equipment proved desirable and profitable.

MECHANIZATION PROBLEMS

There are thousands and thousands of individual farmers in the Philippines at present who consider the native plow the one and only tool that seems to be able to do good tillage work on their small farms. The College of Agriculture has gathered plenty of local data to prove the suitability of tractors and of some agricultural machinery in raising some crops. Some big sugar centrals, the Government owned Land Settlement Administration at Cotabato few big landed estates, and the Bureau of Plant Industry have demonstrated to some extent the efficient and profitable use of some of some mechanized units in large tracts of land. Where men and women are still to be had for planting and harvesting by hand, where method of farming, specially that for lowland rice, has to be carried on in small plots of well puddled mud or on limited areas, and where farmers are still available to work with the meager returns that they get from their farms either as part owners or as tenants, it will not be an easy matter to generalize the use of mechanization. A very thorough process of proving, approving, disapproving, and improving of various farm power and farm machinery will still have to be carried out extensively. What types of farming can best be mechanized, what size of land and machines must be secured to suit various farm conditions, what engines and devices will give the most efficient and profitable return, and what will be the ultimate effect of mechanization to the mode of living, happiness, and welfare of the Filipino people, are the problems that must be well considered in relation to the mechanization of Philippine agriculture.

FOOD FOR THOUGHT

(Reprint)

"The progress of the Western civilization is marked by the improvement of the plough. The pre-historic plough was the crooked stick drawn by man. It was merely a scratching tool. Every man was his own draught animal Somehow the farmer and his family could manage to eke out their existence with this crude method of tillage. In India too we find reference to this kind of tool in the hands of Balaram, the brother of Sri Krishna who is considered to be the father of Indian agriculture, Balaram used to carry a plough as his emblem and was also called by the name of Haladhra or the carrier of a plough.

"In ancient Egypt a form of hoe made from a crooked stick used to serve the purpose of a plough.

"The Roman plough which Virgil describes used to be made of two pieces of wood meeting at an acute angle and plated with iron.

"In the middle ages no improvement of the plough was noticed. The Dutch were the first people to greatly modify the Roman plough. They first conceived the fundamental ideas of the modern plough. They made their plough with a curved mouldboard, a beam and two handles. In England in the beginning of the eighteenth century the Dutch plough served as a model...

"In America after the Revolutionary War the English plough was gradually replaced by ploughs made in the United States. Among those who gave first thought to the improvement of the plough, the names of Thomas Jefferson, Daniel Webster, Charles Newbold and Jethro Wood are prominent...

"The Indian plough is a wedge-shaped toothed implement provided with one handle, a long wooden beam and a long iron pointed share all attached to its wooden body. It stirs the soil all right but inverts it very little. It closely resembles a medieval plough. It takes much time and labour to prepare a seed bed with this plough...."

—The Allahabad Farmer, (India)

Preparation And...

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or turf as floors of the pit. He believes that these materials are obstacles for the earthworms to get access into the compost materials. Earthworms and microorganisms in the soil aid greatly in the decomposition of the compost materials. Earthworms provide fertilizing substance when they die after performing humus formation activity.

3. The maintenance of the proper amount of moisture is one of the most important requirements of the com-

4. The fermentation occurring inside of the pile is a life process, hence the pile must be allowed to breathe. and it should be well aerated.

5. A compost pile that is too dry requires watering. Dry compost gets hot very easily and fermentation is destroyed.

6. The guiding principle is the fact that the compost pile itself must be treated as a living organism because of the bacterial content and its internal fermentation.

7. In the case of a big compost heap, turning the pile is necessary. In turning, the outside of the orignal heap should be made the inner part of the new, and the former inner part now becomes the new outside. It results into a uniform decomposition of the compost materials in the same heap.

8. Weeds should not be allowed to grow on the compost pile. A growth of grass on the pile is harmful because it prevents the air from coming into the pile due to its thick root system, thus precluding fermentation.