8. VARIOUS PROBLEMS ON CULTIVATION TECHNIQUES ON MAIZE IN INDONESIA

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Introduction

Rice and corn are the two most important cereal crops grown in Indonesia and serve as staple foods in the diet of the people. At the present time there is a shortage of these two grains which is due in part of the yearly increase in population. The total planted area is about three million hectares. Almost two-thirds is planted in the maize belt areas of Central-Java, East-Java and Madura. Considerable maize is also grown in Sulawesi, Sumatra, Bali and the Lesser Sunda Islands. In Table 1 is given the statistics for corn in Indonesia. It is interesting to note that there has been some increase in the total production, because of increasing the acreage, but the average yield is still constant (±0.9 ton per hectare).

Table 1. Total area and production of corn in Indonesia for the year 1950 through 1957 and 1960 though 1966.

Year	Area (1,000 hectares)	Production (1,000 tons)	Average yield (ton/hectare)
1950	2,031	1,571	.77
1951	1,798	1,398	.78
1952	2,232	1,638	.73
1953	1,969	1,815	.92
1954	2,518	2,720	1.08
1955	2,042	1,971	.97
1956	2,232	1,965	.88
1957	2,097	1,800	.86
1958+1959 The data not available			
1960	2,639	2,460	.93
1961	2,462	2,283	.93
1962	3,175	3,242	1.02
1963	2,533	2,358	.92
1964	3,644	3,768	1.03
1965	2,536	2,282	.90
1966	3,185	3,005	.94

Source: Central Bureau Statistics.

Some Problems We Are Facing

The maize belt area is concentrated in Java and made up most entirely of small holder farms. Most of the corn planted in Indonesia has a short maturity period (85-

days) and is grown in low elevations (Table 2). More 54 per cent of corn planted requires less than 90 days to mature. These early maturing varieties have a low yielding potential.

Table 2. Percentage of land planted to corn grouped according to three elevation levels and six maturity periods.

Elevation in meters	Days of maturity						Total for each elevation group
	80	85	90	95	100	100<	
0–250	13.47	28.71	20.17	0.46	0.37	1.49	64.67
251–750	0.11	12.07	0.59	12.77	2.43	4.48	32.45
751–1,500	—	0.06	0.07	0.26	0.17	2.32	2.88
Total for each maturity group	13.58	40.84	20.83	13.49	2.97	8.29	100

Source: Miscellaneous Contribution No. 29. From the General Agricultural Research Station, Bogor, Indonesia (by R.I. Jackson).

Another point I would like to stress is the problem of capital requirements and financing to fulfill the technical conditions and the strategic inputs for improving maize production. Under conditions usually existing in traditional subsistance agriculture, the key problem in most cases is the lack of production possibilities and very limited investment opportunities on farming and farm-related operations.

There is some complex linkages that are involved in this farm business picture, i.e., dometic and foreign market demand and price, production cost, capital etc..

In conclusion of these small increase in production annually, more must be done to make the country self-sufficient in food including maize. The daily consumption of cereals is still below the standards. The Indonesian intake from cereals average 1,163 calories per day. Compared to other Asian countries this is a relatively low caloric intake. It is assumed that all of the grain is eaten by the people and none is used as feed for livestock nor for commercial processing.

General Outlook in Research

A highly significant and positive correlation was obtained between yield of maize and number of days to maturity. By using early maturing varieties we can expect the daily increase in yield of dry grains 10 kg to a hectare in low fertility, and 21 kg to a hectare by using adequate fertilizers.

Much greater gains and economically feasible can be made with the use of longer maturing varieties along with using adequate fertilizers. The gains can be made up to 35 kg daily to a hectare.

By replacing the very early maturing varieties with ones requiring 10 to 15 days more or longer, a large increase in maize production can be expected without the use of more land.

Maize breeding program in Indonesia is focused on the development of high yielding synthetic, composite and open-pollinated varieties. Introductions of germ plasm from abroad will be a great aid in the breeding program. When the Indonesian farmers are acquainted with improved corn varieties, then double cross hybrids can be developed and distributed to the farmers. Hybrids can developed while the Extention Service is promoting the use of improved open-pollinated varieties. The advantages of having synthetic and composite varieties are that it is higher yielding than an open-pollinated one, seed can be produced as though it were an open-pollinated and consequently seed

Table 3. Grain yield (kg/ha sun dry) of different varieties at 11 locations, wet season 1967/1968.

Variety \ Location	Taman-bogo	Kunin-gan	Mardjo-sari	Ampel	Ngale	Delanggu	Modjo-sari	Kedjajan	Muneng	Wongso-redjo	Genteng	Mean	% over *Metro*
Eto Synthetic 1(2)	3,340	4,390	4,425	2,542	2,870	1,680	610	1,931	3,010	3,430	1,495	2,571	94
Eto MS_2	3,870	6,425	3,505	2,385	3,200	1,570	720	2,616	3,315	3,195	1,775	2,961	101
Eto × Dorado	4,255	6,340	4,380	2,854	3,695	1,545	830	1,831	3,220	3,685	1,910	3,140	107
Wonosobo Composite	5,195	6,440	4,716	2,729	3,570	1,660	835	2,571	2,900	4,010	1,700	3,291	113
Metro Synthetic (2)	4,080	4,965	3,980	2,667	3,855	1,355	875	2,537	3,345	3,645	1,585	2,990	102
Rocol V 351	3,705	4,890	3,650	2,083	3,135	1,405	675	2,005	2,530	3,295	1,200	2,597	89
Bogor Composite 1	4,675	5,500	3,755	2,687	3,585	1,580	275	2,910	2,835	3,355	1,515	2,970	102
〃 〃 2	4,620	6,220	3,690	2,896	4,265	1,770	1,190	2,959	2,730	3,595	1,595	3,230	110
〃 〃 4	4,760	6,840	4,090	2,760	3,935	2,055	980	3,325	3,075	3,620	1,345	3,344	114
〃 〃 5	5,020	6,135	3,745	2,458	3,870	1,450	680	2,943	2,780	3,635	1,250	3,088	106
Bogor Synthetic 1	4,380	5,320	4,340	3,359	3,445	1,440	1,480	1,863	3,475	2,885	1,350	3,031	104
〃 〃 3	4,430	6,350	4,210	2,922	3,495	1,490	1,240	2,975	2,845	3,460	1,515	3,176	109
Checks													
*Metro****	3,595	5,860	4,390	2,615	3,600	1,750	585	2,053	2,555	3,790	1,385	2,925	100
Harapan	4,210	5,465	4,380	2,786	3,485	1,665	675	2,461	2,835	4,170	1,840	3,088	106
Bogor Synthetic 2 (Permadi)	4,705	6,460	4,165	2,927	3,645	1,780	1,305	2,269	2,890	3,345	1,575	3,188	109
Local variety	5,020	4,550	1,835	2,448	2,455	735	1,025	2,375	600	3,195	550	2,253	77
Mean	4,366	5,793	3,954	2,695	3,507	1,558	874	2,476	2,809	3,519	1,466		
L.S.D. at 5%	812	747	621	456	485	465	439	932	675	469	469		
C.V. (%)	13.2	9.1	11.1	11.9	9.1	21.0	35.1	26.3	16.8	9.3	22.3		

*** Improved by controlled mass selection.

production is relatively simple and inexpensive (Table 3).

Practically no, or at most very little, fertilizer is used on maize. There are three main reasons for this: First, the lack of availability of the fertilizers to the farmers; second, the shortage of funds for the farmers to buy fertilizer; third, the fact that the farmers have not been trained in the use of fertilizer and its practical benefits. Some of these problems are more difficult to overcome than others, but all of them should be surmounted so that grain production can be increased through the use of fertilizers.

The extremely important method of increasing yields of maize in Indonesia is through the application of commercial fertilizers, farm manure and the growth of green manure crops especially by using these high yielding varieties, all corn fields will show some response to nitrogen. It is very interesting to note that the most important is the striking response of these longer maturing varieties to nitrogen and the yield profit can be seen from the average results from 10 field experiments on Redish Brown Latosol (Figure 1).

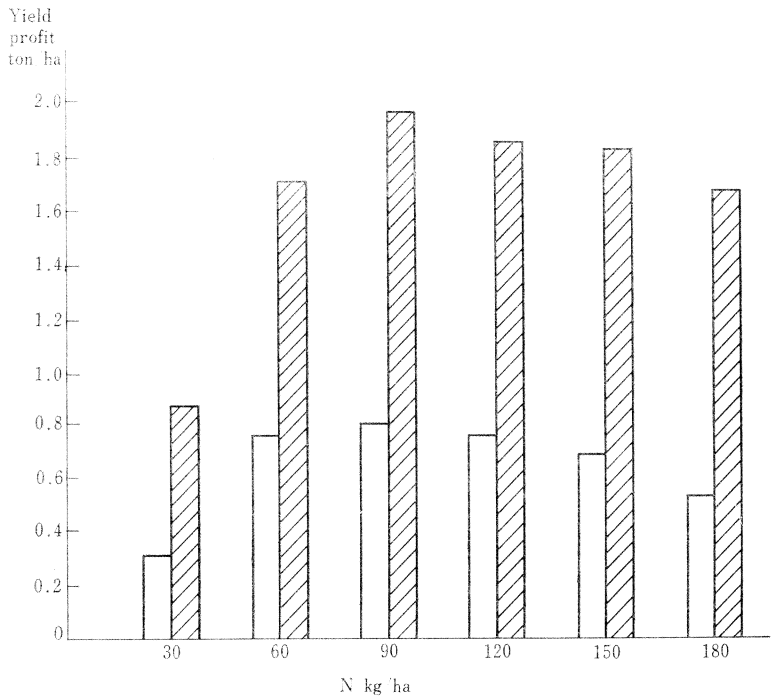

Figure 1. Effects of nitrogen fertilizer rate on field profit of corn in ton per hectare of dry grain.

=var. Pendjalinan, 85 days.

=var. Harapan, 100 days.

The result of the study of fertilizer use and application have been shown that it is usually possible to obtain yields of 3 to 5 tons per hectare of grain from maize in Indonesian soil with fertilization, suitable cultural practices and improved varieties provided that sufficient moisture is available. Even in the absence of optimum moisture

and cultural practices, significant and profitable yield increase from fertilizer are usually obtained. Confirming to the earlier work, nitrogen was found to be the limiting element, but phosphorous will be required in many locations also. Splitting the nitrogen application was shown to be beneficial.

Conclusion

There are three acceptable agricultural practices that might be employed to overcome the deficiency without increasing the labor devoted to production: First, more land may be put into cultivation by using power machinery to underwrite the extra work load; second, fertilizers or green and stable manure might be applied to stimulate production; third, adapted improved varieties may be planted in replacing of present lower producing varieties.

Providing credit at reasonable rates of interest to the farmers they would improve agricultural production. In transforming traditional subsistance agriculture to modern commercial agriculture, there must be an infusion of capital for the use of agriculture in order that the required technology and strategic inputs can be made available to the farmers. This impressive break through in agricultural production may very well create a stimulating climate of new and profitably attractive oppotunities for capital investment in the agricultural sector of the economy.

Developing, testing and demonstrating improved, high yielding varieties. The goal of training personnel is necessary indeed.

Much more work needs to be done on seed production and distribution and get into a good working organization. It is expected that new varieties and hybrids will be developed at the Research Station. Seed of these new varieties will have to be produced and distributed to the farmers to make maximum use of them. These must be widely grown by the farmers and seed must be available to them if production is going to be increased. It must be cheap and convenient for the farmers to buy.

There is a shortage of commercial fertilizers in the country and until factories can be built to produce them they will have to purchased from abroad. It is still more economically sound to use foreign currency to import fertilizers than grains or food which would result in saving the country's limited supply of foreign exchange for Five Year Plan.

Discussion

T. Sato, Japan: Maize is not so called a plantation crop. But in humid tropics (the greater part of Indonesia belongs to it), we can practise about 3 croppings in a year or even 7 croppings in two years. So I think, as a plantation system we can profitably and effectively grow maize. How do you think about this idea?

Answer: 1. We have 3 croppings—4 croppings; 2 × corn, 1 × rice, 1 × soybean (etc.). 2. We can make more cropping if the moisture is available (irrigation).

P. Phit, Thailand: What is the reason of great variation in the acreage since 1962 to 1965? Namely, in 1962 the acreage is increased by 713,000 ha. In 1963 a decrease of 642,000 ha. In 1964 new increase of 1,111,000 ha. In 1965 new decrease of 1,108,000 ha.

Answer: In 1962: Export is available (is allowed) by the government. In 1963: Dry season is very long (8 months) and the production dropped. In 1964: Action program on corn for export purpose with a good support from the government and A.I.D.. In 1965: Because we can not handle the production of 1964 and the corn grain spoiled. The spirit of the farmer dropped.

S. Harada, Japan: Please let me know the days to maturity of the following varie-

ties; Malin, Metro, Permadi, and the other new varieties which you are recommending now.

Answer: Malin: ca. 100 days for low elevation (0–500 m from sea level). Metro: ca. 110 days for low elevation (0–500 m). Permadi: ca. 96 days for low elevation (0–500 m). BIMA: ca. 140 days for high elevation (1,500 m). Bogor Synthetic 2 and 4: ca. 97 days for low elevation (0–500 m).