Prospects of Maize Farming Development in the Rainfed Lowlands of Indonesia

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Abstract. Parts of Indonesia such as Sulawesi Island have potential for development of maize farming. Maize cropping has recently been increasing rapidly at 20-30% per annum, particularly in the lowlands of the country. Given an impetus, maize can compete with rice production. So more emphasis should be placed on planting maize in the rainfed lowlands, especially since technology is available to enhance productivity and cost efficiency. Toward this objective, integrated maize management trials were conducted in Sidrap regency in South Sulawesi during the dry seasons of 2006 and 2007. The results indicated that planting maize OPVs (Lamuru and Srikandi Kuning-1) produced an average of 4-4.5 t ha^{-1} with a benefit of Rp. 4.6 million ha^{-1} and a return:cost ratio of 2.31. This shows the marked promise of developing maize in the rainfed lowlands.

Key words: Production, rainfed lowland, maize

Introduction

Maize is cultivated in diverse environments in Indonesia. Based on surveys of the past 20 years, Mink *et al.* (1987) reported that about 79% of Indonesia's maize cultivation takes place in the dry season. About 11% of it is in the lowlands, and 10% in rainfed lowlands. Maize cultivation in lowland areas, particularly rainfed lowland areas, has been increasing by 10-15% and 20-30% respectively, predominantly in the commercial maize production areas (Kasryno 2002). Area increase has been more rapid for dry-season maize (93.5%) than wet-season (1.5%). East Java and Lampung provinces are the predominant maize-producing areas in Indonesia. Farmers in Central Java, Yogyakarta and South Sulawesi also cultivate maize in the lowland areas where it is the most preferred crop after rice.

Development of dry-season maize in the lowland areas is a strategic policy of the Indonesian Government for several reasons: (1) there is a maize production deficit during the dry season; (2) dry-season maize grain quality is better than wet-season; and (3) farmers find dry-season maize more beneficial (ICERI 2007). The potential for maize development can be realized if farmers obtain the benefits they hope for from the crop. To achieve that purpose, we need cultivation technology that enables high productivity and cost-efficient production and yields quality produce that is competitive in the market (Zubachtirodin *et al.* 2007).

To achieve optimal maize productivity, integrated technology management (ITM) is an appropriate approach to create a synergistic effect ofthe many kinds of component technologies involved such as high-yielding varieties, seed quality, land preparation, optimal plant population, efficient fertility, pest and disease control and harvest and postharvest management (IAARD 2008).

Methodology

Our research, using a participative approach, was conducted in Sidrap regency in South Sulawesi during the dry season in September 2006 and October 2007 on 5 ha and 10 ha respectively. The coastal western region of South Sulawesi was selected for the study because (a) South Sulawesi holds promise of growth in maize production, especially in the dry season; (b) South Sulawesi is an important part of the Corn Belt Program with the objective of boosting maize production to 5 million t a year; and (c) the western part of South Sulawesi has a large expanse of rainfed lowlands which are not currently cultivated in the dry season and are not optimum for rice.

Data for our study was gathered through Rural Participatory Appraisals (RPAs) and respondent cluster surveys determined sample (purposive sampling) from farmer cooperator of 27 people. The number of respondents was determined based on 5-10% of maize farmer population or depend on homogeneity of cultivated area (Teken 1973). Primary data collection was done through respondent interviews based on a questionnaire. Secondary data was obtained from institutions such as the Agriculture Department, the Central Statistics Bureau, the Irigation Department and the Extension Central Bureau.

The survey covered all the technologies implemented through the Integrated Technology Program for rainfed lowlands, ie, land preparation, sowing, weed control, fertilization, pest and disease management, irrigation, harvest and processing, yield and marketing. The data were tabulated and subjected to descriptive analysis (Anonymous 1987).

Results and Discussion

Among the several maize varieties that have been introduced, farmers preferred Lamuru and Srikandi Kuning-1 most, mainly because they possessed superior characteristics: Lamuru is drought-tolerant while Srikandi Kuning-1 has higher protein content than normal maize. According to the Agriculture Extention Services report for 2006, there are 12 poultry farms in Sidrap regency which would need a lot of maize for their feed.

The maize technology implemented by farmers varied from incomplete application of the recommended technology to complete application by a few. The yields achieved by the farmers varied too. Cooperator farmers achieved yields of 3.20-4.94 t ha^{-1} with the variety Lamuru and 3.82 t ha^{-1} with Srikandi Kuning-1 in 2006. In 2007, the grain yield of Lamuru ranged 3.03-752 t ha^{-1} (Table 1). This was still short of the yield potential of Lamuru (7.60 t ha^{-1}) and Srikandi Kuning-1 (7.92 t ha^{-1}) (Syuryawati *et al.* 2007).

To attain higher productivity (a minimum of 6.0 t ha^{-1}) we need to improve technology at the farmers' level through perfect implementation of the recommended technology. Research results based on survey data and farmer interviews indicate that the component technologies that have to be more efficiently implemented are irrigation cover and drainage, fertilizer application and timely weed control. Rat infestation during the grain-filling stage, a factor that decreases grain yield, is facilitated by the presence of noncultivated land around the maize plots. Although dry-season rainfall is not sufficient for rice cultivation, farmers in this area still sow rice every year as a habit, even if drought is a distinct possibility. The farmers are not aware that sowing maize in these water-stress conditions would be more beneficial than rice.

The constraints cited above can be overcome through use of adequate resources and by making use of market opportunities. Land isavailable in this area and water resources such s dams or wells with pump to irrigate maize can be harnessed. We found that poultry farms were ready to buy maize grain in large amounts; so marketing would be no problem in this area. Conditions such as these will support development of maize cropping on a large scale here.

Table 1 presents an analysis of the production costs and returns of cooperator farmers in Sidrap regency who adopted the integrated plant management approach in 2006 and 2007.

Analysis of costs and returns showed that for an average yield of 4.09 t ha^{-1} for Lamuru) and 3.82 t ha^{-1} for Srikandi Kuning-1), the production value obtained in 2006 by farmers was Rp. 6 544 000 ha^{-1} and Rp. 6 112 000 ha^{-1} respectively at a grain price of Rp. 1600 kg^{-1}. In 2007, an average production of 4.53 t ha^{-1} fetched a return of Rp. 8 154 000 ha^{-1} at a grain price of Rp.1700 kg^{-1}. The R:C ratio achieved by these cooperator farmers was >1 in the two years of the study (2.12-2.31), indicating that maize farming could be beneficial provided the farmers implemented the recommended production technology. Although productivity was less than optimum, the prospects are conducive for development of maize farming in this area.

Table 1. Production costs and returns[1] of Lamuru and Srikandi Kuning-1 maize varieties in the rainfed lowlands of Sidrap, South Sulawesi, 2006-2007.

Item	Variety		
	Lamuru		Srikandi Kuning-1
	2006	2007	2006
I. Production (Rp. ha^{-1})	6 544 000	8 154 000	6 112 000
II. Production costs (Rp. ha^{-1})			
- Material[2]	1 665 000	2 130 000	1,665 000
- Labor[3]	1 226 300	1 400 000	1 214 800
Total	2 891 300	3 530 000	2 879 800
III. Income (Rp. ha^{-1})	3 652 700	4 624 000	3 232 200
IV. R:C ratio	2.26	2.31	2.12

1. Maize grain value at harvest: Rp. 1600 kg^{-1} (2006) and Rp. 1700 kg^{-1} (2007).
2. Material: seed, fertilizer (urea, Phonska, KCl), herbicide, pesticide, gasoline.
3. Labour: Land preparation/drainage, sowing, fertilization, weed control, pest and disease control, irrigation and harvest.

The following five component technologies need to be implemented in farmers' lands forintegrated plant management of maize production:

1. High-yielding, composite/open-pollinated varieties (OPVs) that are suitable for the land and its environment, cropping system, and local farmer preferences in lowland and rainfed lowland areas.
2. Quality seed (purity/certificate and germination capacity >95%, seed treatment with metalaxil 2 g per kg of seed to control downy mildew and carbofuran applied 3-5 granules per plant hole to control ants and seedling fly).
3. Plant population/density between 66 600-70 000, with plant spacing of 75 cm × 40 cm at 2 plants per hole or 75 cm × 20 cm at 1 plant per hole in the wet season, and plant spacing 70 cm × 40 cm at 2 plants per hole or 70 cm × 20 cm at 1 plant per hole in the dry season.
4. Nitrogen fertilization (urea) based on the plant growth phase and leaf colour chart (LCC). P and K fertilization based on the soil nutrient status agree with laboratory analysis or local recommendation. Organic matter or manure 1.5-3.0 t ha^{-1} as seed cover to overcome nonfertile land especially in acid soils.
5. Water channel construction (for cropping on dryland in the wet season) or distribution channel (especially cropping on lowland in the dry season).

If the five technology components are simultaneously implemented, it would increase maize production and make it more efficient.

Conclusions

- There is limited interest in cultivating maize in the dry season. Farmers still prefer rice even if there is limited water during the dry season.
- Maize productivity in farmers' fields is less than the potential. Average maize yields reached 4.1 t ha^{-1} for the Lamuru variety and 3.8 t ha^{-1} for Srikandi Kuning-1. Maize grain yields could be raised through enhanced crop management.
- The returns from maize are substantial: for eg, the Lamuru variety returned Rp. 3.7-4.6 million ha^{-1} and Srikandi Kuning-1 Rp. 3.2 million ha^{-1} with return:cost ratios >1 (2.12-2.31). Maize farming is thus a promising option in the rainfed lowlands.

References

Anonymous. 1987. Social and economic research and planting pattern training. Nusa Tenggara Agricultural Support Project. IAARD in collaborated with Agricultural Economics Department. International Rice Research.

IAARD. 2008. General guide for integrated plant management. IAARD and Agricultural Development. Department of Agriculture. 27p.

Agriculture Extention Services. 2006. Work zone potential of extension services Sidrap regency, South Sulawesi.

ICERI 2007. Highlights ICERI 2006. Institute of Agricultural Assessment for Research Development. Central Research and Food Crops Development. ICERI 50p.

Kasryno F. 2002. Production development and world maize consumption during the last four decades and implications for Indonesia. Paper presented on maize agribisness, Bogor, Jun 24, 2002. IAARD.

Mink S.D., Dorosh P.A. and Pery D.H. 1987. Corn production system: pages 62-87 *in* The corn economy of Indonesia. Timmer (ed.).

Syuryawati, Rapar C. and Zubachtirodin. 2007. Description of high-yielding maize. 5th edn. IAARD, ICFORD, ICERI. 115p.

Teken. 1973. Economic social research method. Bogor Agriculture Institute.

Zubachtirodin, Buntan A., Margaretha S.L., Firmansyah I.U., Tenrirawe A., Faesal, Tandiabang J., Dahlan H.A., Kamaruddin A., Panikkai S., Ilyas and Sinuseng Y. Maize technology production in suboptimum land through integrated plant and resources management. Final report. IAARD, ICFORD, ICERI. Agriculture Department. 34p.