Demand for Technology Innovation and Transfer to Maize Farmers in South Sulawesi, Indonesia

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Abstract. This paper illustrates the demand for technology innovation and transfer to maize farmers in South Sulawesi Province. Data for this study was gathered through Participatory Rural Appraisals (PRA) conducted in several subdistricts of this province and also from secondary data sources. The pattern of maize varieties used in this province has been changing. In 1995 local/white varieties accounted for 40.0% of the usage, open-pollinated superior varieties 48.6% and hybrid maize varieties 14.4%. Over the next 10 years, the use of local varieties decreased to 16.2% and that of open-pollinated superior varieties to 23.4% including Quality Protein Maize (QPM) varieties. The share of hybrid maize varieties rose to 55.6% in 2007 although in 2006 it was only 29.6%. Innovation technologies have been used by some farmers. Farmer groups are using open-pollinated superior varieties and hybrid varieties. The other technology innovations adopted have been use of zero and minimum tillage, site-specific nutrient recommendations, improvement in postharvest handling technologies like threshers, drying and processing equipment. These technologies were recommended by the Indonesian Government through the Agricultural Technology Committee. Initiatives to transfer technology innovations to farmers have included demonstrations, case studies and communication development. The strategy and methods to disseminate technology innovations have included (1) direct communication to the clients; (2), learning through media like leaflets, folders, and booklets; and (3) a combination of both methods.

Key words: Maize farmers, technology innovation, transfer methods

Introduction

Maize is a strategic commodity in Indonesia because of its multiple uses as food, feed and raw material for industry. As a food commodity, maize is second in importance to rice. Suryana (2006) reports that the contribution of maize to Indonesia's economy has doubled in three years, from 2004 to 2006, growing from Rp.9.4 trillion to Rp.19.2 trillion. However, maize production is still not sufficient to meet domestic demand, and imports are needed. The Ministry of Agriculture planned to achieve maize self-sufficiency in 2007, and then to expand production for export. The targets were not achieved. Farmers hope to increase production by adopting new technologies.

Farmers of South Sulawesi used to cultivate local white varieties of maize in the upland areas for food purposes. Later they used to sow open-pollinated superior varieties in the dryland in the rainy season. Under the government-supported maize development program named BIMAS Palawija (Mass Guidance for Second Crop Intensification), farmers have been planting not only white corn and open-pollinated superior varieties, but also hybrid maize varieties in the drylands in the rainy season, and in irrigated lands after the rice crop. The Mass Guidance or *BIMAS* approach delivered both technology innovations and production resources like fertilizers and insecticides.

Innovation is defined as a new idea, practice or object that is successfully introduced into economic or social processes (Hartwich *et al.* 2007). In agriculture, innovations can include new knowledge or technologies related to primary production, processing and commercialization all of which can positively affect productivity, competitiveness and livelihoods of farmer and others. Both maize price and good seed assistance from the government can motivate farmers to adopt technological innovations and increase their production. The government's objective of increasing maize production by 2.24% per year can be attained by increasing productivity and expanding the planting area.

This assessment paper is aimed at strengthening activities to increase maize production by adoption of innovation in South Sulawesi, Indonesia.

Methodology

Data for this paper was collected through Participatory Rural Appraisals (PRAs) in several subregencies of South Sulawesi, especially the regencies of Bulukumba, Takalar, Bantaeng and Bone. Secondary data was obtained from related institutions and assessment data from AIAT of South Sulawesi.

Results and Discussion

Maize planting area, production and trends

Development of maize in South Sulawesi has been related to the other staple foods of the people of this area, especially rice. When rice used to be sown during only one season (rainy season) every year until the 1960s, farmers used to plant while local varieties of maize in the upland dry areas and in rainfed lowlands area after rice. The pattern of food consumption of rice for six months and maize or rice mixed with maize in the other six months was reflected in the management of maize.

Initiatives have been undertaken in recent decades to increase maize production and productivity in South Sulawesi. There have been changes in the composition of maize varieties used. In 1995, 40.0% of the maize varieties used were local/white varieties, 48.6% open-pollinated superior varieties and 14.4% hybrid maize varieties. In the one decade since then, the composition has changed: the share of local varieties has decreased to 16.21% and that of open-pollinated superior varieties to 23.42% including Quality Protein Maize (QPM) varieties such as Srikandi Kuning-1, while the share of hybrid maize varieties rose to 55.56% in 2007 although in 2006 it was only 29.6% (Table 1). The sharp increase in the total area of maize hybrids was mainly due to seed assistance from the government. Local white varieties used to be the staple food of people in some districts, but with the increase in rice production in South Sulawesi, the number of people using maize as the main food has decreased.

Adoption of modern varieties, including hybrid varieties and inputs, have helped increase yields.

Table 1. Distribution of maize varieties, 2006 and 2007.

Maize varieties	Year of production			
	2006		2007	
	Planted area (ha)	%	Planted area (ha)	%
Local (white, glutinous)	32 590.48	15.1	34 751.05	16.2
Superior open-pollinated including QPM	86 979.80	40.3	50 198.64	23.4
Hybrid				
F_2 or F_3 hybrid	63 885.98	29.6	119 129.88	55.6
	32 374.65	15.0	10 321.67	4.8
Total	215 831	100	214401.21	100

Source: UPTD BPSB Tanaman Pangan dan Hortikultura Propinsi Sulawesi Selatan 2007.

Production has grown 8.86% from 639 414 t to 696 084 t, and productivity 5.08% from 3.210 t ha-1 to 3.373 t ha-1.

Demand for technology innovations

Several agricultural technologies have been introduced to farmers and farmer groups in this region. Some of them have been successfully adopted such as open-pollinated superior varieties and hybrid varieties and zero and minimum tillage. Site-specific nutrient management has also been recommended but not successfully adopted by farmers yet. Improvement in postharvest handling technologies like using threshers, drying and processing has been recommended. The government's recomendations for the maize planting seasons of 2008 and 2008/2009 are summarized in Table 2.

The other innovations include growing certified seed, of both open-pollinated superior varieties and hybrid maize varieties, by farmer groups as part of the Seed Grower Base Community System and local enterprise. Farmers have adopted hybrid maize seed as a production technology innovation which could increase their production and income. Production of certified seed of open-pollinated superior varieties including Quality Protein Maize (QPM) variety Srikandi Kuning-1, and hybrid maize varieties will be developed as part of the community-based development initiative.

Adoption of technology is dependent on farmers' motivation. In the case of adoption of new crop varieties, farmers not only consider the capacity of the crop to boost productivity, but also other characteristics such as resistance to drought, flooding, pests and disease. A lack of assets such as land, education or equipment (eg, pumps), can also limit adoption. So more attention needs to be paid to technologies that require fewer assets and less expensive inputs.

Transfer of technology innovations

Innovators are agents, farmers, processors or other private sector entities who introduce and adopt innovations. Researchers and extension personnel are inventors, knowledge communicators who assist the innovator in the conduct of the innovation, which in any case may also occur without their contribution. Training farmers and bringing to them training materials that are understandable to those with low literacy can help them adopt a new technology. Cultural characteristics influence adoption in many different ways, such as preferences for certain tastes and textures.

Table 2. Summarized recomendations for development of maize in South Sulawesi Province of Indonesia for planting seasons 2008 and 2008/2009.

No.	Subject	Wet season	Dry season
1.	Land Resources		
	Upland areas	Upland rice + maize Maize	- Soybean
	Irrigated lowland areas	Rice	Dry season 1 : Rice Dry season 2: Maize zero tillage
	Rainfed lowland areas	Rice	Maize zero tillage
	Rainfed lowland areas with pump irrigation	Rice	Maize zero tillage (dry season 1)
2.	Technological innovations		
2.1	Seed and varieties	Certified seed (commercial seed) Varieties recommended: Open-pollinated superior varieties like Lamuru, Sukmaraga, Bisma, Gumarang, Srikandi Kuning-1 (QPM) Hybrid varieties: BISI, Pioneer, Bima 1, Bima 2, Bima 3	
2.2.	Fertilizer amount	250-300 kg urea ha^{-1} 100-150 kg SP 36 ha^{-1} 50-100 kg KCL ha^{-1}	
	Fertilizer application	Application of urea 3 times: 1. At 7-10 DAS; 2. 28-20 DAS; 3. 40-45 DAS Third application based on LCC measure	
2.3.	Weed control	Manual weeding two times: 14 DAS and 30 DAS. Or using herbicides	
2.4.	Pest control	Seed treatment with fungicide Metalaxyl for downy mildew; Using resistant varieties and proper planting times; Maize stem borer controlled by insecticide if more than one group of larvae or eggs hatched per 30 plants. Cutworm or armyworm controlled if more than two larval groups from eggs hatched per 36 plants. Applied Carbofuran 3 G 10 kg ha^{-1} through tip of maize.	
2.5.	Postproduction handling	Threshing and cleaning with machine, and drying manually or with dryer.	

[1]DAS = Days after sowing.
Source: Dinas Pertanian Tanaman Pangan dan Hotikultura Propinsi Sulawesi Selatan (2008).

Dissemination pathways, how people learn about or obtain a technology play a fundamental role in determining who will adopt a new technology. Aidar *et al*. (2002) reported that of the media used to communicate effectively, 88% learn from leaflets and only 50% from booklets. Both media could grow up of maize production by 43.3%, time efficiency by 35% and cost efficiency by about 21%. A broad range of dissemination methods were used to promote maize in South Sulawesi Province for three decades. However, there was no one "best" method of dissemination for all regions or groups of farmers within one region. So, dissemination is specific to location, ethnic group, knowledge level, attitudes and practices of farmers or farmer groups.

According to Sumarno (1997), some of the technologies developed by research were not adopted by farmers because: (1) there was a barrier of communication between the source of innovation and the farmer; (2) many innovations are developed away from the farmers' fields without involving the participation of farmers; (3) there are problems relating to socioeconomic conditions and environmental resources; and (4) there are problems internal to farmers.

Show case of technology innovation is a dissemination method successfully used in maize because: (1) it establishes a direct relation with the client (farmers and their families); (2) it is conducted on farmers' lands with the participation of farmers, (3) it uses multimedia, visual, verbal and printed material; (4) it can be documented and used again by other people efficiently and effectively combining with other instructional media (Aidar *et al*. 2002). A case study on zero tillage for maize in Takalar Regency (with 50 farmer respondents) showed that 50% of farmers found it easy to obtain herbicide, all of them said zero