Nestle Soya Farm's Perspective on the Potential of Soybean For Crop Diversification in Irrigated Areas

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Introduction

Soybean importation in the Philippines is a perennial problem since domestic' soybean production has not been sufficient to meet local demand. In 1983 alone, 30,555 tons of raw soybeans and 260,954 tons of soybean meal were imported to sustain the protein requirement of the poultry and livestock industries.

The pursuit for an import-free soybean industry has long been an unrealized dream in the Philippines. Since the 1970's, local scientists geared efforts to package technologies on soybean production adaptable to Philippine conditions. National soybean programs have been launched to boost production but were not successful. Development work were mostly initiated by government institutions. Since 1981, the Crops Research Division of the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) has emphasized the research and extension situation. The development of crop production strategies and their integration with farming systems has been identified as one of the problem areas and recommended research activities.

Nestle Philippines, Inc.'s Interest in Soybeans

Nestlt Philippines had been providing quality food products for 77 years now. In 1978, it was the first private food manufacturing company ever to take serious interest and investment in soybeans. Banking on the premise that if soybean-based food products would be acceptable in the local market, then such product would be readily accepted in other developing countries.

It has been Nestles policy to procure the raw materials it needs from local farmers and other independent sources. This commitment is exemplified by its Agricultural Services Department's continuous research, development and extension activities providing technical assistance and support.

Raw materials for soybean-based products in Nestlé Phils were obtained from limited contract growers. Since 1979, the Nestlé Soya Farm at Crossing Rubber, Tupi, South Cotabato provided production services to soybean farmers in terms of technical and extension guidance, subsidized seed loan, pesticide loan and market assurance. Harvesting and post-harvest facilities were also made available at cost.

Soybean deteriorate rapidly especially under ordinary room storage. The need for fresh bean supply prompted Nestlt Soya Farm Management to investigate the potential of expanding its services to irrigated areas to meet its year-round demand, Tupi and most traditional soybean growing areas are rainfed and upland-based fanning. Numerous research reports had supported the potential of soybean in irrigated areas for crop diversification. Problems have been identified but solutions need further investigation.

Water Requirement of Soybean

The water requirement of soybean varies depending on location, season, variety, soil and climate. Generally, soybean requires more water to sustain an optimum yield compared with corn. Weiss (1983) stated that 600-1000 mm rainfall is required to produce 2,000 kg/ha of soybean seeds. Evapotranspiration is 13% higher in soybean than in sorghum for the same leaf area. There are

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*Area planted as of 7 September 1988. Average yield taken from 65 hectares harvested area to date.

assumptions that soybean requires 400 t/ha of watertoproduce 1.0 t/ha of dry matter (AVDRC, **1975).** In instances where water is not limiting, 60% of soybean roots develop within the upper 20 cm soil layer. More than 80% of the water absorbed by the plant is being supplied by roots 40 cm or deeper. Planting in AVDRC dry season (January 1975), revealed that it is possible to obtain high soybean yields if sufficient water is applied initially for germination. The highest yield was **3.1** t/ha, harvested on 13 May. Total rainfall during the experiment was **117** mm which fell mostly in late April and early May. The average evaporation rate was **5.4** mm/day. About 200 t/ha of water was applied after planting to ensure good germination. Apparently 3,200 t/ha of water was obtainedfrom the soil even in the middle of the dry season by capillary action

lo tropical regions, two to three well-timed irrigations is usually necessary (FAO, **1961).** In Nebraska, maximum yield per unit of water was achieved after starting with the soil at field capacity and irrigating once just before flowering. The amount of moisture **a** soybean crop uses throughout the growing season is shown in Figure 1. Soybean uses relatively little moisture at planting and shortly afterwards. However, it is profitable to irrigate within a few days after planting in coarse sand because of the soils' less water holding capacity. If moisture loss delays germination and the onset of vegetative growth, yield may be reduced (Superior Soybean Production, Circular **1200).** For high yields, ample vegetative growth especially in leaf **area** is required. Plant types that have reached **40** cm or more at flowering would have adequate vegetative size to support high

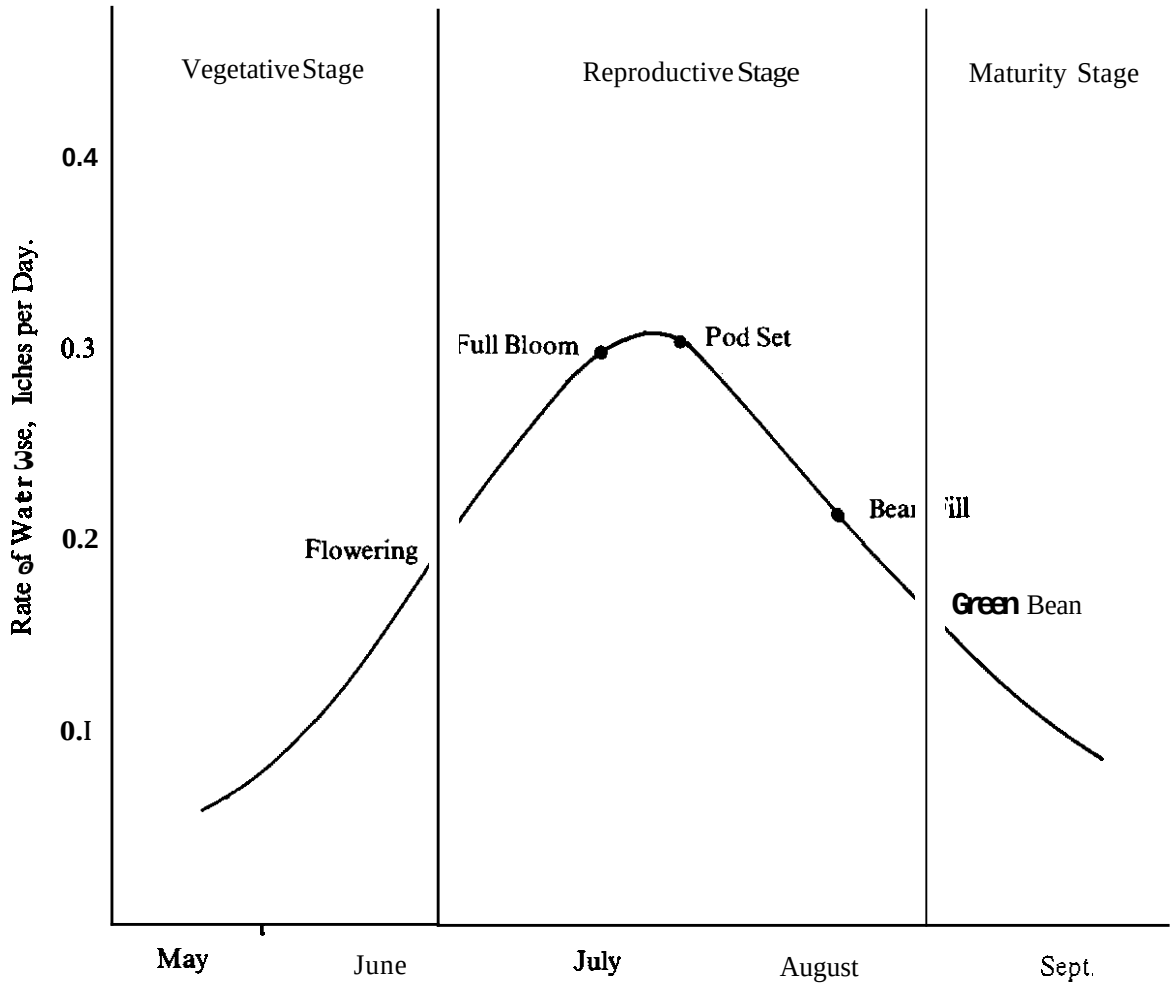

Figure 1. Amount of moisture used by the soybean crop throughout the growing season adaptedfrom Soybean Handbook, Cooperative Extension Service, Kansas State University.

reproductive growth (AVDRC Soybean Report, 1975). Of the 500-760 mm of water that soybean uses, 60-70% is required from 40-100 days after emergence. There should be enough moisture throughout this stage to promote steady, rapid growth of vegetation (Superior Soybean Production, Circular 1200). Plant canopy should be fully developed by pod set to intercept the maximum amount of light and prevent further evaporation of residual moisture. Determinate varieties will more likely require irrigation during vegetative period. They are less tolerant to moisture stress and cease vegetative growth when flowering begins. During flowering, soybean can recover better than corn from moisture stress because of its longer flowering period. Under the best conditions, only a fourth of the flower set pods. But in severe moisture stress, pod abortion can still occur. Results of research conducted by IOWA State University indicate that as few as four consecutive days of visible moisture stress during the pod set and bean filling stages can reduce soybean yields to as much as 40% (Figure 2). Irrigation should therefore be sustained late enough to prevent serious moisture stress until the leaves begin to turn yellow.

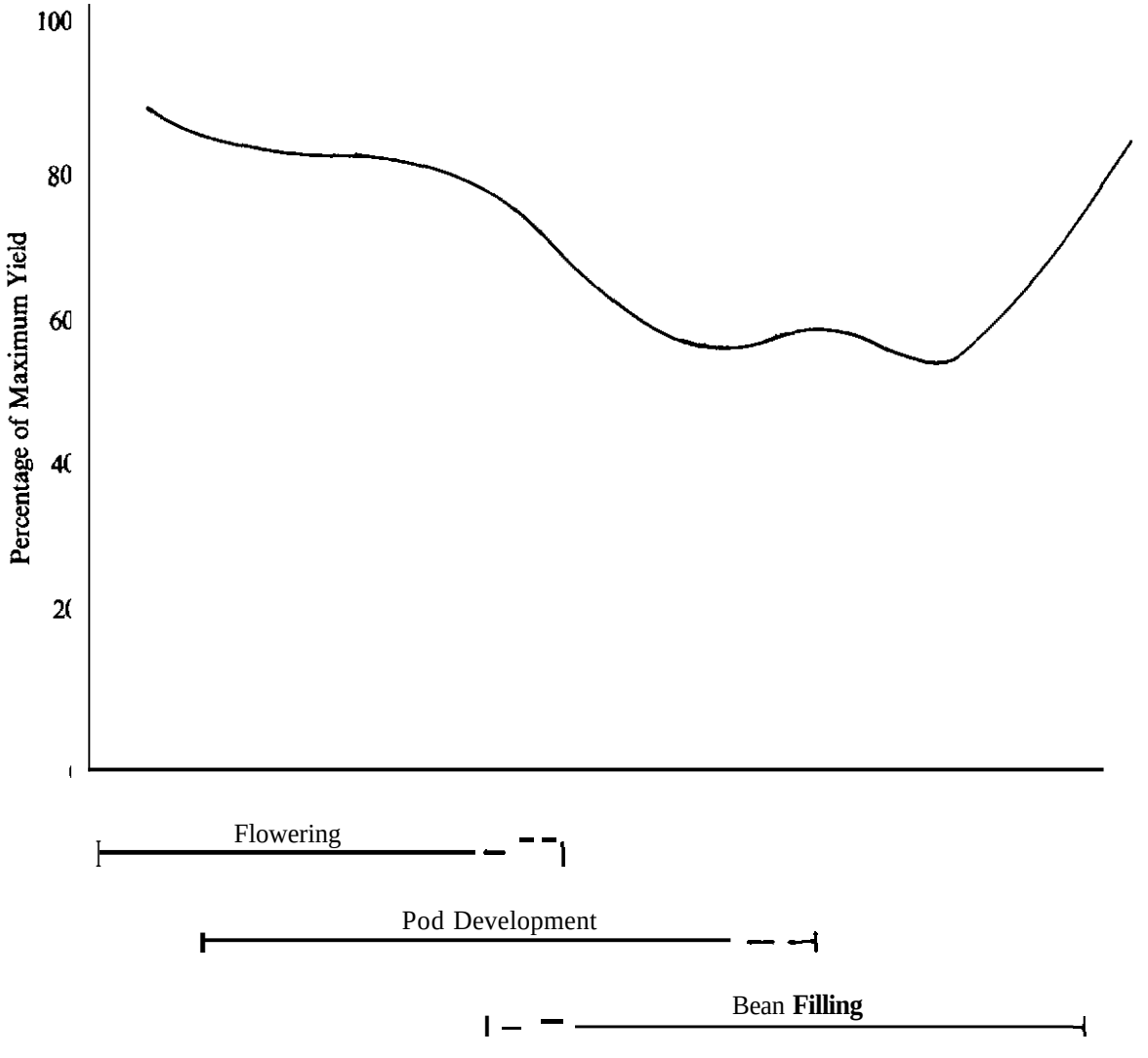

Figure 2. the effect an soybean yield of visible moisture stress symptoms. Moisture stress can have an especially serious effect during late pod development or early in the bean filling stage, reducing yield by as much as 4° percent (adapted from R.H. Shaw and D.R. Laing, "Moisture Stress and Plant Response," in Plant Environment and Efficient Water Use).

Soybean Production Areas and Status

Rainfall Pattern

Soybean production in Mindanao is dependent on rainfall. Majority of soybean areas are rainfed. Irrigated areas are seldom devoted to soybean production. Figure 3 shows the rainfall pattern of some soybean producing areas. San Miguel, Surigao del Sur, with a potential of 800 hectares for soybean, has only one cropping season per year. Planting starts from March to June. Heavy rainfall between October and February limits the cropping to only one per year. The same situation exists in Mati and Cateel, Davao Oriental. Tupi, South Cotabato has a potential for two regular croppings i.e. April to June and August to October. Banga and Surallah, South Cotabato have relatively lower rainfall during most of the year. Two croppings are possible but a lot of areas are served by irrigation systems. Trial plantings of soybean after the dry season rice crop has been initiated in these areas since 1984. Problems identified were water scheduling, planting schedule in relation to regular rice cropping, farmers' technology on soybean production, financing and quality.

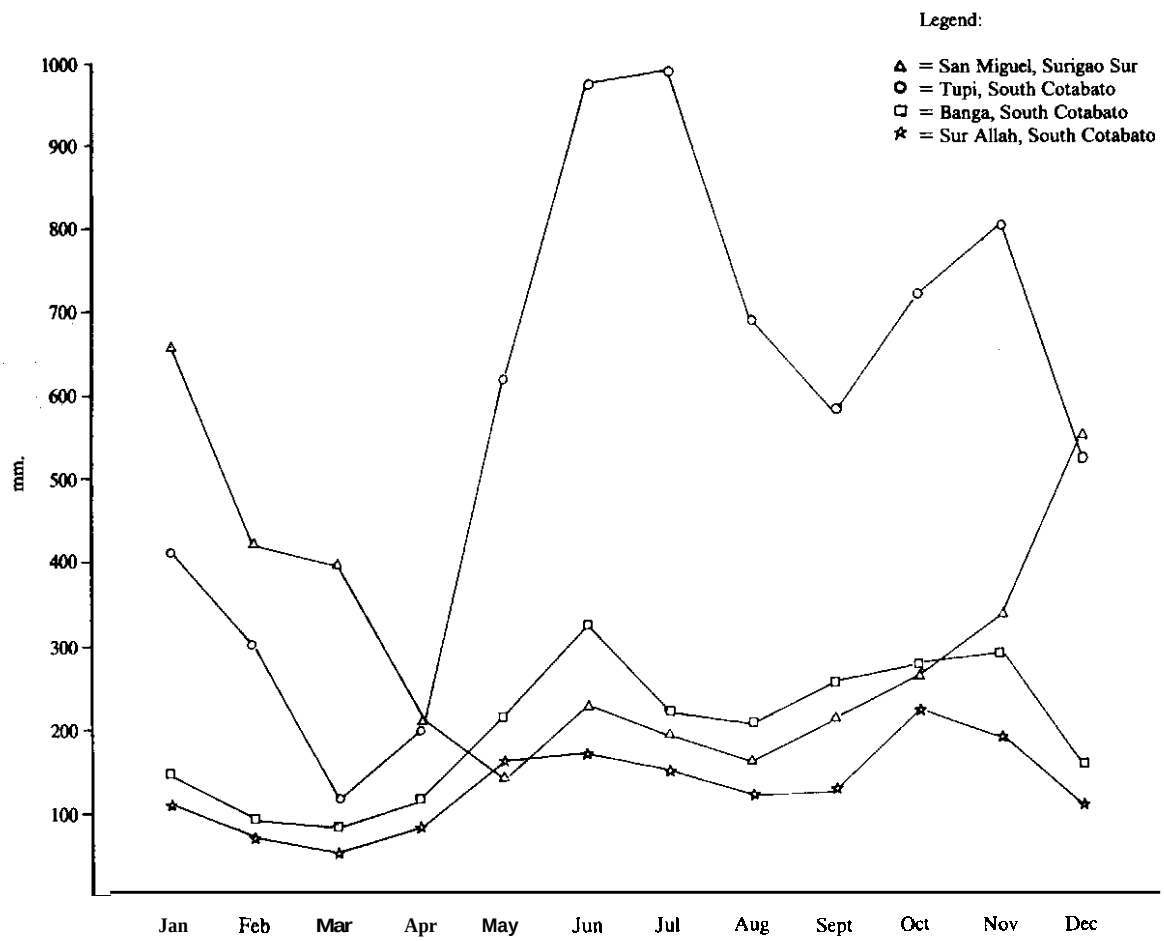

Figure 3. Monthly rainfall pattern of some soybean production areas. (Average 198 -87).

Table 1. Soybean production data at Nestlé Soya Farm, 1984-1988.

	1984	1985	1986	1987	1988'
Area planted (ha)	163	438	200	310	292
No. of cooperators	123	255	162	246	222
Ave. area per farmer (ha)	1.3	1.7	1.2	1.2	1.3
Ave. yield (kg/ha)	0.8	0.9	1.12	1.09	1.32

*Area planted as of 7 September 1988. Average yield taken from 65 hectares harvested area to date.

Table 2. Monthly average yield (kg/ha) and area planted from 1986-1988, Tupi, South Cotahato.

	January		February		March		April		May	
	Yield	(ha)	Yield	(ha)	Yield	(ha)	Yield	(ha)	Yield	(ha)
1986	939	9.0	1902	3.0	1653	1.2	1071	1.5	1439	46.0
1987	1351	2.8	547	3.0	390	0.5			1354	32.6
1988	1183	2.0	1215	3.6	631	7.0	1534	28.8	1135	26.6
Ave.	1158	4.6	1221	3.2	891	2.9	1302	15.2	1244	35.1

Crop Performance

Table 1 shows that soybean yield per hectare increased gradually from 1984. Intensive varietal development and technical assistance coupled with active extension support were the reasons for such an increase over the national average of 0.88 t/ha. The number of farmer-cooperators and hectarage varies from season to season and from year to year depending on raw material requirements for soybean products and farmgate price of soybean relative to other cash crops.

Table 2 shows that planting was done between January and March. Although there were differences in monthly averages for three years, planting in January and February gives higher yield than in March. Upland areas planted in January and February are in Tampakan and Banga, South Cotabato (ranging from 5-10 hectares) with irrigation systems that utilize three to four flush flooding during the entire growing season. Plantings in March in Surallah, South Cotabato are mostly in lowland irrigated areas after a rice crop. However, the crop was given only one to two flush-flood irrigation, hence, the low yield. Moreover, harvesting of the crop planted in March coincided with the rainy month of June creating post-harvest problems and quality risks. However, it is evident that with enough water supply, soybean planted outside the normal wet and dry season cropping is feasible. together with technical training of the farmer on the improved practices on soybean production. November-December planting has not yet been investigated in South Cotabato. Proper choice of non-photoperiodic varieties and planned on-farm variety trials in target areas will be very beneficial. A variety identified to be suitable for lowland rice-based cropping system was UPL-Sy2. Nestlé Soya Farm will still be very active in expanding its production services to potential irrigated areas to satisfy its fresh bean requirements all year round.

Conclusion

The data presented were micro in scope and achievements but they indicated the potential of soybean as an alternate for crop diversification especially in irrigated areas where water supply is less than what is required for rice. However, planting date should be carefully planned in connection with the cropping pattern so as to avoid harvesting during the rainy months. Water supply and scheduling should be properly programmed

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