

## Studies on the Effect of Maize and Soybean Association in Different Proportions and Spacing on Yield

By

N. T. JAGANATHAN<sup>1</sup>, Y. B. MORACHAN<sup>2</sup> and S. RAMIAH<sup>3</sup>

### ABSTRACT

Study on the possibility of introducing maize soybean mixed crop revealed that 1:2 proportion recorded significantly more monetary benefit than the other proportions tried and pure crops. The pure crop of maize yielded 8.26 t/ha, while 1:2 proportion of maize and soybean yielded 6.65 t/ha of grain and bean valued at Rs. 4610/ha.

### INTRODUCTION

Maize is well known for the higher tonnage and soybean is recognised as the cheapest source of protein and oil. Markley (1950) observed that maize-soybean mixture was remunerative. Sysarov (1968) reported that ridge cultivation of maize and soybean yielded better than conventional method. Narang (1967) observed that soybean as a companion crop with maize did not have any harmful effect on morphological characters of maize. Sekhon and Bedwa (1953) found an increase in the yield of maize when inter cropped with soybean resulting in net increase of food grain per unit area.

### MATERIALS AND METHODS

An experiment was conducted at Agricultural College farm, Coimbatore

during *kharif* 1971, under split plot design, with four replications. The main plot treatments consisted of three proportions of maize Ganga-5, and soybean E.C. 39821 viz., 1:1, 2:1 and 1:2 besides pure crop of each, while the sub-plot treatments comprised of two levels of row spacing viz., 60 and 75 cm.

The crops were raised as per the recommended package of practices. A uniform fertilizer dose of 108 kg N, 54 kg P and 36 kg K per ha was adopted for the mixtures and pure crops. Five plants in each plot were selected at random for recording biometric data. As both the crop varieties were of the same duration, they were harvested on the same day.

As the area occupied by maize and soybean was different in various proportions of the mixture, the yields

1. Instructor in Agronomy, 2. Professor and Head and 3. Assistant Professor, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore-641003

could not be directly compared; they were converted to that of pure crop on the basis of 'ground utilization' for the net plot area of 31.2 sq. m as adopted by Aiyer (1949).

## RESULTS AND DISCUSSION

The biometric data recorded are presented in Table 1 and 2.

### Maize:

#### Length and girth of cob:

All the proportions of mixtures recorded significantly increased cob length over the pure crop of maize, the highest being recorded in<sup>o</sup> 1:2 proportion. This is presumably due to the legume-cereal association providing a good part of the nitrogen required for cereal at the later stage, as observed by Whitney *et al.* (1967). In 2:1 proportion of the mixture significant increase in mean girth of cob was recorded as compared to other proportions which are on par.

#### Grain weight of cob:

The mean grain weight per cob was increased significantly in all the proportions than in pure maize. Under 1:2 proportion the highest weight was recorded followed by 2:1 and 1:1 proportions respectively, and the lowest was recorded in pure crop. Due to lesser population of maize plants in the mixture than pure crop, better uptake of nutrients and consequently increased weight of cob can be expected as evidenced by Nagpur (1966) and Chipde (1966).

### Test weight of grain:

In respect of hundred-grain weight which is an important factor deciding yield, 1:1 proportion was better than the rest. The pure crop of maize recorded the lowest test weight of grain. The wider row spacing of 75 cm recorded higher test weight than the narrow row spacing of 60 cm. Interaction effect between the proportion and spacing was also observed. At any one level of spacing 1:1 proportion recorded significantly higher test weight than the rest of the treatments. Such a performance of cereals sown in equal proportion of legumes was reported by Ayyangar and Sankara Ayyar (1941) and Raghavulu (1967).

### Grain yield:

The yield of grain in 1:2 and 1:1 mixture was significantly increased than pure crop of maize. Among the spacing levels narrow spacing of 60 cm had recorded significantly higher yield than wider spacing of 75 cm. The probable reasons for the increase might be due to the favourable association of the two crops, the complementary effect and more plant density.

### Straw yield:

The straw yield was increased significantly more in all the proportion. The same was higher in narrow row spacing of 60 cm than in 75 cm, due to increase in plant population at lower level of row spacing.

### Soybean:

#### Number of branches:

The number of branches per plant was increased significantly more in the

TABLE 1. Effect of maize and soybean mixture on the yield, its attributes and economics

Plant characters and yield	Maize soybean 1 : 1	Maize soybean 2 : 1	Maize soybean 1 : 2	Pure crop of maize	Pure crop of soybean	S. E.	C. D. (P=0.05)
<b>Maize</b>							
Length of cob [cm]	21.55	21.50	22.25	18.10	—	0.45	1.38
Girth of cob [cm]	16.50	16.00	17.25	15.85	—	0.24	0.71
Grain weight per cob [g]	186.25	188.00	221.55	144.00	—	1.05	3.20
Hundred-grain weight [g]	33.25	30.06	27.80	24.86	—	1.12	3.40
Yield of grain [q/ha]	112.08	89.33	140.06	82.60	—	8.30	26.53
Yield of straw [q/ha]	120.22	80.67	144.23	115.77	—	9.29	30.13
<b>Soybean</b>							
No. of branches/plant	3.50	3.40	3.60	—	3.60	0.60	0.14
No. of three seeded pods/plant	7.25	8.62	10.75	—	6.87	0.70	2.30
Hundred-bean weight [g]	12.66	12.55	11.83	—	12.16	0.12	0.39
Yield of bean [q/ha]	17.31	16.99	14.74	—	16.67	1.67	N.S.
Total grain and bean yield of maize and soybean [q/ha]	71.67	67.88	66.54	82.60	16.67	4.49	14.74
<b>Economics</b>							
Gross receipts [Rs/ha]	4100	3510	4610	4130	2500		
Net return [Rs/ha]	2850	2260	3360	2880	1250		

Soybean valued at Rs. 150/q, maize at Rs. 50/q.

Cultivation expenses for mixture as well as pure crops of maize and soybean are taken at Rs. 1250/ha.

pure crop of soybean, 1:2 and 1:1 mixtures than in 2:1 proportion. There was a trend of increase in the number of branches of soybean under wider spacing of 75 cm than 60 cm. This is in conformity of the results of Lehman and Lambert (1960).

#### Number of three seeded pods:

The mean number of three seeded pods per plant significantly increased in 1:2 and 2:1 mixtures. The lowest number of three seeded pods was recorded in the pure crop of soybean.

#### Test weight of seed:

The highest hundred bean weight was recorded under 1:1 and 2:1 pro-

portions and significantly superior to the rest of the treatments. This is again an important yield deciding factor in soybean.

#### Yield of bean:

The bean and bhusa yield on equi-ground utilization basis due to either different proportions or due to spacing level did not vary significantly. However, 1:1 and 2:1 proportions recorded numerically higher yields. This clearly indicates that soybean yield does not suffer on account of the association with maize.

#### Total grain yield of maize and soybean:

In the combined grain yield of both maize and soybean, pure crop of

TABLE 2. Effect of row spacing on yield of maize and soybean mixture

Plant characters and yield	60 cm row spacing	75 cm row spacing	S. E.	C. D. (P=0.05)
<b>Maize</b>				
Two or more cobed plants (%)	51.00	52.00	0.90	3.00
Hundred-grain weight (g)	28.47	29.50	0.32	0.98
Grain yield (q/ha)	113.17	98.88	3.01	9.29
Straw yield (q/ha)	122.15	108.40	3.53	11.54
<b>Soybean</b>				
Hundred bean weight (g)	12.33	11.86	0.08	0.27
Total grain and bean yield of maize and soybean (q/ha)	69.52	55.54	1.28	5.77

maize recorded significantly increased yield. However, the performance of pure maize was on par with 1:1 and 2:1 proportions and superior to the rest of the treatments. Therefore, it is obvious that cereal legume association is capable of yielding to the level of pure crop of a cereal as regards grain yield, though not superior. When considering the total production of protein and money value, it is evident that the cereal legume mixture is preferred over pure crop of either cereal or legume. This is in accordance with the findings of Nageswara Reddy and Chatterjee (1973).

Among the spacing treatments narrow row spacing of 60 cm recorded higher combined yield than 75 cm. The interaction effect of proportions and spacings on the total grain yield was significant.

#### Total straw and bhusa yield:

The combined total yield of maize straw and soybean bhusa was significantly more in all the proportions tried than 2:1 proportion. The same was significantly higher in the narrow row spacing of 60 cm than in 75 cm evidently due to the increase in plant population.

#### Economics of Maize and Soybean mixed crop:

It is clear that 1:2 proportion of maize and soybean recorded the high-

est profit than other proportions, followed by pure maize. Raghavulu (1967) reported 1:1 cereal legume mixture to be the best.

Soybean as a pure crop fetches very little money value but when mixed with maize in 1:2 proportion is capable of securing higher profits than pure crop of maize. When considering the need of the day for more production of protein and oil, growing of crops like soybean cannot be lost sight of.

#### ACKNOWLEDGEMENT

The permission accorded by the Tamil Nadu Agricultural University for publishing this part of the M. Sc. (Ag) dissertation is gratefully acknowledged.

#### REFERENCES

- AIYER, A. K. Y. 1946. Mixed Cropping in India. *J. Agric. Sci.* 19 : 439-43.
- AYYENGAR, G.N.R. and M.A. SANKARA AYYAR. 1941. Rotation and mixed crops with Sorghum. *Mudras agric. J* 29: 57-63.
- CHIPDE, D. L. 1966. Studies on the effect of association of mung in various combinations with and without phosphate on the growth and yield of Kharif jowar. *Nagpur agric. College Mag.* Diamond Jubilee special Research number 127.
- LEHMAN, W. F. and J. N. LAMBERT. 1960. Effect of spacing on Soybean. *Field Crop Abstr.* 20 : 1867.
- MARKLEY, S. 1950. "Soybean and Soybean products" Inter Sci. Publishers, I N C., New York.



- NAGESWARA REDDY, M. and B.N. CHATTERJEE. 1973. A note on mixed cropping of soybean with sorghum. *Indian J. Agron.* 18: 238-9.
- NAGPUR, N. S. 1966. Studies on the effect of association of mung (*Phaseolus aureus*) in various combinations with and without phosphate on the growth of Kharif Jowar (*Sorghum Vulgare*). *Nagpur agric. Coll. Mag. Diamond Jubilee special Research Number.* 142.
- NARANG, S. D. 1967. Inter cropping of maize with soybean. *Indian Fmg.* 19: 21.
- RAGHAVULU, P. 1967. *Studies on the effect of association of a millet and pulse in different proportions in the presence of nitrogen, phosphorus* M. Sc. (Ag) Thesis. Madras University.
- SEKHON, C. S. and H. C. BEDWA. 1953. Role of soybean in increased food production in the Kangra district. *Punjab Farmer* 5: 17-8.
- STINGON, H. T. and D. N. MOSS. 1960. Some effects of shade upon corn hybrids tolerant and intolerant of dense planting. *Agron. J.* 52: 482-4.
- SYSAROV, N. D. 1968. Ridge cultivation of maize and soybean. *Field Crop. Abstr.* 22.
- WHITENY, H. S., Y. KANIHIRO and G. O. SHERMAN. 1967. Nitrogen relationship of three tropical forage legumes in pure stand and in grass mixtures. *Agron. J.* 59: 47-50.