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INFLUENCE OF PLANT POPULATION AND PLANTING GEOMETRY OF SUNFLOWER FOR PEANUT INTERCROPPING ON YIELD OF OILSEEDS AND OIL

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SUMMARY

The possibility of intercropping peanut in sunflower was explored at Hyderabad in India to maximize the production of oilseeds and oil. Peanut density of 333,333 plants/ha was intercropped in equidistant, paired, or skipped rows of sunflower each at a plant population of 55,555; 66,666 and 74,074 plants/ha. Sunflower and peanut yields were reduced in different intercrop treatments. But, the total oilseed production showed substantial improvement. Peanut intercropping in paired or skipped rows of sunflower with 55,555 or 74,074 plants/ha maximized the total oilseed production and oil yield while maintaining significant superiority over the sole crops.

Key words: Sunflower, peanut, planting geometry, oil yield.

INTRODUCTION

The edible vegetable oilseed production in India barely meets the demand and consumer requirement of fats. Peanut is the traditional and major source accounting for more than fifty percent of the total vegetable oil (Reddy, 1991). In recent years sunflower is prominently cultivated owing to its low production cost, high quality oil, less duration and versatality to varied soils and environments. Literature indicated that its yield is stable over a wide range of plant populations (Robinson et al., 1982; Muthuvel, 1983; Shaik Mohammad and Sagar, 1983 and Miller et al., 1984) and array of planting geometry (Beard et al., 1976 and Sharma and Singh, 1987). This phemonenon has lent a view that the spatial and density variables could be evaluated to grow peanut as an intercrop and exploit the potential to increase the oilseed production and oil yield per unit area.

MATERIALS AND METHODS

A field experiment was conducted in the rainy season during 1988 on the alfisols of the students farm of the Andhra Pradesh Agricultural University at Hyderabad in India. A total of 429 mm rainfall was received during the crop growth period. It was well distributed but ceased later causing a stress for 35 days to peanut. The soil had a pH of 8.5, was low in available nitrogen (250 kg N/ha) but high in available phosphorus (40.32 kg P/ha) and potassium (64.70 K/ha). Sunflower 'Morden' was intercropped with peanut 'Robut 33–1' at 55,555, 66,666 and 74,074 plants/ha sown in 3 geometries viz., equidistant, paired, and skipped rows of sunflower were studied. Peanut population was maintained at 333,333 plants/ha in each treatment. Sunflower at the recommended density of 74,074

and peanut at 333,333 plants/ha were the sole treatments. These eleven treatments (Table 1) were tested in four replications in randomized block design. Sole sunflower was fertilized with 80 kg N, 26.4 kg P and 23.6 kg K/ha, while peanut received 30 kg N, 44 kg P and 67.2 kg K/ha. The intercrop treatments were furnished with 110 kg N, 44 kg P and 67.2 kg K/ha.

The oilseeds yield data were statistically analyzed following the univariate (Snedecor and Cochran, 1967) and the relatively recent approach – the bivariate analysis of variance (Pearce and Gilliver, 1978).

RESULTS AND DISCUSSION

Grain/pod yield

The grain yield of sunflower and pod yield of peanut were less than the sole crops in different intercrop treatments (Table 1). However, the reduction in yield of sunflower was not significant when it was grown at the density of 74,074 plants/ha and intercropped with peanut in the paired rows. The total produce of oilseeds realized by intercropping peanut in paired and skipped rows of sunflower plant populations maintained at 55,555 or 74,074 plants/ha was significantly more than the yield obtained from either sole crops.

With the mean population of 55,555 plants/ha sunflower produced significantly less grain than with 74,074 plants in the intercrop treatments. Conversely, the intercropped peanut yielded significantly more in the high than the low density treatment of sunflower. The total yield of oilseeds was however on par from both density variables in intercropping. With 66,666 plants/ha sunflower yield did not increase appreciably while it caused a significant reduction in yield of peanut. Therefore, the total oilseed production was significantly less at this density compared with 55,555 plants/ha.

The variable planting geometry also had a substantial influence on the yield of the component crops. The overcrowding of plants owing to the intimate planting distance reduced the yield of both sunflower and peanut in the equidistant row intercrop treatment. The paired and skipped rows provided more space and reduced the interspecific competition. The two crops therefore yielded more and maximized the total oilseed production. Statistically significant differences for grain yield of sunflower and total oilseed production were in favour of dpaired over equidistant intercrop treatments.

In the recent interpretation of yield data in intercrop systems, the univariate method of analysis has come in for criticism. It is argued that the two species are likely to impart some effect on the growth of each others. Their performance should therefore be adjudged in conjunction. Hence the yield data were further analyzed following the bivariate method.

The results are plotted on skewed axes in Fig.1. The correlation coefficient was negative (r=0.19) and corresponded to < cos 0 = 79"03' indicating the prevalence of competition between the two crops imparting ill effects on each other. Peanut intercropping in equidistant, paired and skipped rows at the densities of 55,555, 66,666 or 74,074 sunflower plants/ha enhanced the total oilseed production significantly more than the sole crop yield of either species. The univariate anlysis on the other hand showed that the total yield advantage due to intercropping in equidistant rows at the three density variables and the paired or skipped rows at 66,666 plants/ha of sunflower was not

Table 1. Effect of peanut intercropping in sunflower on grain/pod and oil yield

Treatment		Grain /pod yield (kg/ha)			Oil yield (kg/ha)		
		Sun-flower	Peanut	Total	Sun-flower	Peanut	Total
1.		2.	3.	4.	5.	6.	7.
Sunflower plant population 55,555 plants/ha							
T_1	Sunflower equidistant rows (60x30cm) + 2 rows of peanut	702	904	1606	263	245	508
T_2	Sunflower paired rows (40–80x30cm) + 3 rows of peanut	799	938	1737	264	247	511
T_3	Sunflower paired rows (60–120x20cm) + 4 rows of peanut	704	1003	1707	229	297	526
Sunflower plant population 66,666 plants/ha							
T_4	Sunflower equidistant rows (75x20cm) + 2 rows of peanut	778	736	1514	262	197	459
T_5	Sunflower paired rows (50–100x20cm) + 3 rows of peanut	776	813	1589	260	230	490
T_6	Sunflower paired rows (75–150x15cm) + 5 rows of peanut	747	846	1593	252	240	492
Sunflower plant population 74,074 plants/ha							
T_7	Sunflower equidistant rows (45x30cm) + 1 rows of peanut	735	683	1418	241	190	431
T_8	Sunflower paired rows (30–60x20cm) + 2 rows of peanut	849	887	1736	283	237	520
T_9	Sunflower skipped rows (45–90x20cm) + 3 rows of peanut	828	885	1713	280	316	596
T_{10}	Sole sunflower (45x30cm)	921	–	921	324	–	324
T_{11}	Sole peanut (30x10cm)	–	1453	1453	–	448	448
SE ±		44	88	101	21	41	30
CD 5%		90	180	206	44	91	61
Plant population							
55,555 plants/ha		735	948	1683	252	263	515
66,666 plants/ha		767	802	1568	258	223	481
74,074 plants/ha		804	819	1623	269	247	516
Planting geometry							
Equidistant rows		739	774	1513	255	211	466
Paired rows		808	880	1688	269	138	507
Skipped rows		760	914	1671	254	284	538
SE ±		25	51	51	12	26	17
CD 5%		52	104	103	NS	73	37

significantly different from the pod yield of sole peanut. Interestingly, the figure provides another contrast that the mean density effect was significantly superior with the population of 55,555 over those with 66,666 and 74,074 plants/ha. The paired row planting held its significant superiority over the equidistant row treatment as in the univariste analysis.

Oil yield

The oil yield of sunflower was reduced to 70.7 – 87.3% of that of the sole crop in different intercrop treatments. The interspecific competition was more severe on peanut and it produced 42.3 – 70.5% of the oil in sole cropping. But, considering the total

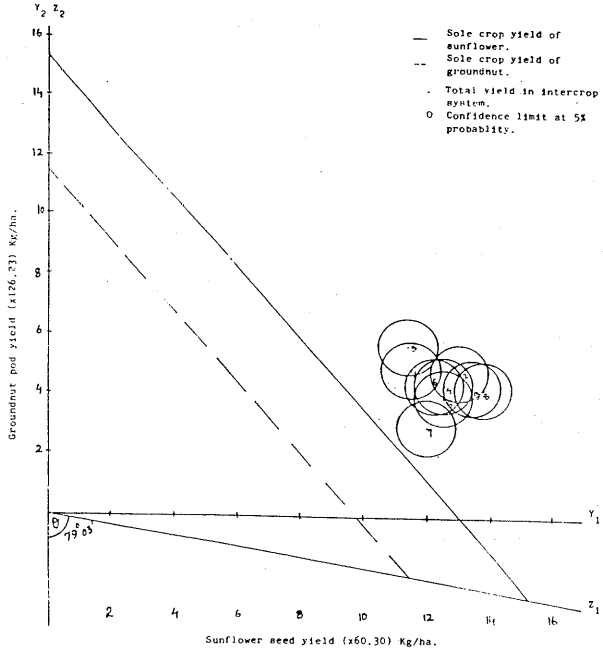
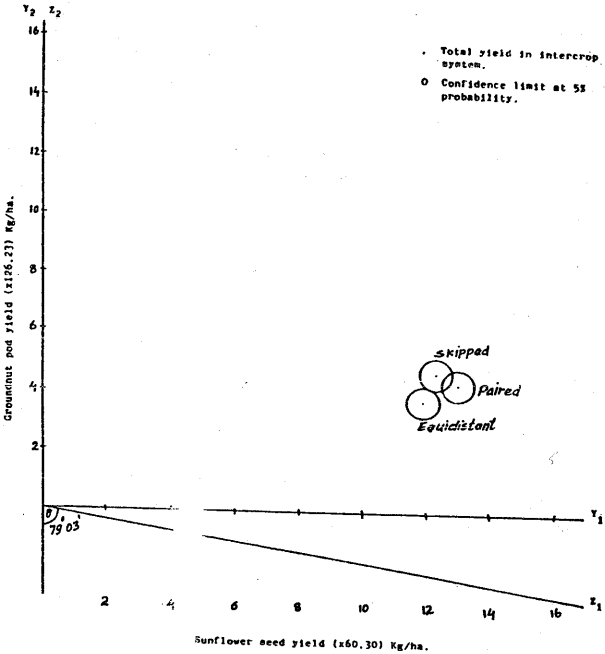


Figure 1 Grain/pod yield of sunflower/peanut in intercrop treatments



Figuire 1a Grain/pod yield of sunflower/peanut as influenced by planting geometry in intercropping system

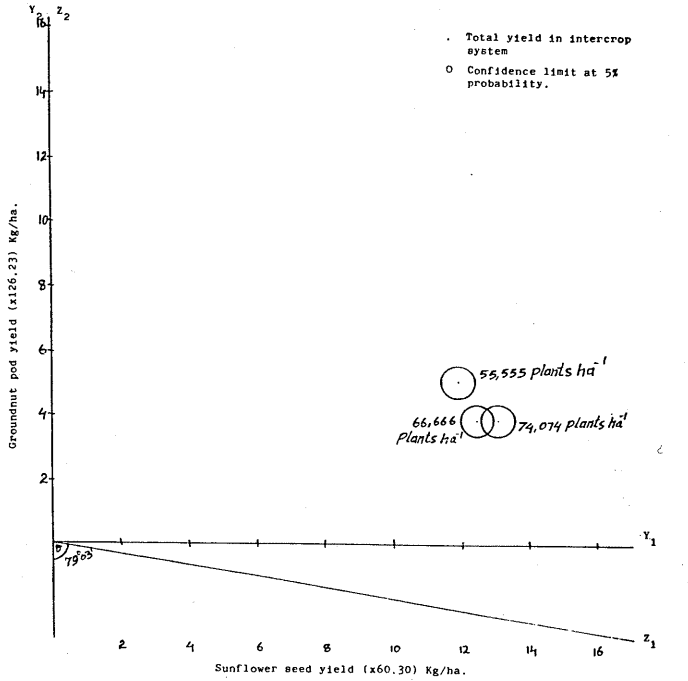


Figure 2 Grain/pod yield of sunflower/peanut in intercrop treatments

quantity of oil, the intercrop treatments were all beneficial to sunflower. They yielded 32.9 – 84.1% more oil and were significantly superior. The intercrop treatments involving paired and skipped rows with 55,555 or 74,074 sunflower plants/ha yielded 13.9 – 33.0% more oil than sole peanut.

The study indicated that intercropping peanut in the paired or skipped rows of sunflower with densities maintained at 55,555 or 74,074 plants/ha is a potent agronomic system for increassing the oilseed production and thus the oil yield per unit area and time.

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INFLUENCIA DE LA POBLACION Y GEOMETRIA DE SIEMBRA DEL GIRASOL EN CULTIVO ASOCIADO CON CACAHUETE SOBRE EL RENDIMIENTO Y ACEITE

RESUMEN

La posibilidad del cultivo de cacahuete asociado con girasol fue explorado en Hyderabad en India para maximizar la producción y rendimiento. El cacahuete con una densidad de 333,333 plantas/ha fué intercalado con el girasol en hileras equidistantes o salteadas con una población de 55,555, 66,666 y 74,074 plantas/ha. Los rendimientos de girasol y cacahueta se redujeron en los distintos tratamientos de cultivo asociado pero, la producción total de ambas oleaginosas experimentó un aumento sustancial. El intercalamiento de cacahuete en hileras pareadas o salteadas de girasol con 55,555 o 74,074 plantas/ha maximizó la producción total y rendimiento graso de ambas oleaginosas, manteniendo una superioridad significativa sobre los cultivos solos.

INFLUENCE DE PEUPLEMENT ET DE LA GÉOMÉTRIE DE SEMIS SUR LE RENDEMENT ET LA TENEUR EN HUILE CHEZ LE TORNESOL CULTIVÉ EN ASSOCIATION AVEC L'ARACHIDE

RÉSUMÉ

La possibilité de cultiver l'arachide en interligne dans du tournesol a été explorée à Hyderabad en Inde, pour maximiser la production de graines oléagineuses et d'huile. L'arachide, à la densité de 333,333 plantes/ha a été cultivée entre des lignes equidistantes, jumeléese ou défaussées de tournesol, chacune de ces modalités étant testées à 55,555, 66,666 et 74,074 plantes/ha. Les productions de tournesol et d'arachide ont été réduites dans les différents traitments, mais au total la production de graines oléagineuses a montré un substantiel accroissement. La plantation en interligne d'arachide entre des rangs jumelés ou défaussés de tournesol, à 55,555 ou 74,074 plantes/ha, a maximisé la production totale de graines oléagineuses et la production huile en maintenant une supériorité significative sur les cultures pures.