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NODULATION, GROWTH AND POD YIELD OF GROUNDNUT UNDER SIX INTERCROPPING SYSTEMS

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A field experiment was conducted during the rainy seasons of 1984 and 1985 to study the effect of intercrops on nodulations, growth, nitrogen content and pod yield of groundnut (*Arachis hypogaea* L.) Tall growing cereal intercrops viz., pearl millet and corn significantly affected the nodulation, plant growth and nitrogen content of plants at pod filling stage (75 days,) while no such effects were observed during the initial stages of crop growth. The above traits were unaffected when groundnut was grown in combination with sesamum, sunflower, soyabean and cowpea. The pod yield was also significantly reduced under cereal intercropping as compared to sole crop of groundnut. The observed effects were ascribed to retarded photosynthetic activity due to shading created by tall growing cereal crops on the groundnut crop canopy.

Groundnut (*Arachis hypogaea* L.) is traditionally intercropped with crops like pearl millet, corn, sorghum, pigeonpea etc. in groundnut growing parts of India by marginal and sub-marginal farmers to realize various advantages associated with the cropping system during rainy season (Reddy *et. al.*, 1980). Intercropping with oilseeds (sunflower, castor and sesamum) and legumes (cowpea, green - gram and soybean) are being popularised recently by the All India Coordinated Research Project on Oilseeds under the aegies of Indian Council of Agricultural Research, New Delhi to meet the domestic needs of both edible oil and pulses (Anonymous, 1985). This paper summarizes the results on nodulation and related traits in groundnut in intercropping of three component crops mainly cereals, oilseeds and legumes.

MATERIALS AND METHODS

The field experiment was conducted during the rainy seasons of 1984 and 1985, using a spanish groundnut (*Arachis hypogaea* Sub sp *fastigiata* var. *vulgaris*) variety GG 2, at Junagadh in black calcarious soil (pH 8.00). Three component crops evaluated were 1. Cereals : Pearl Millet (*Pennisetum americanum* (L.) Leake, Var. BK 560), Corn (*Zea mays* L. Hybrid Ganga Safed); 2. Oilseeds: Sesamum (*Sesamum indicum* L. Var G. Til 1), Sunflower (*Helianthus annus* L. Var. Morden) and 3. Legumes : Cowpea (*Vigna unquiculata* (L.) Walp., Var. Pusa Phalguni) and Soybean (*Glycine max* (L.)Merri, Var. G. Soya. I). The radio of intercrops was 3 rows of groundnut to 1 row of intercrop component. Uniform inter and intra row spacing of 45 cm and 15 cm respectively was followed.

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A sole crop of groundnut served as control. The experiment was laid out in a randomized block design with 4 replications in a plot size of 6.5X3m. A basal dose of 12.5 Kg N (Urea) and 25 kg P_2O_5 /ha (Single Super Phosphate) was applied to all crops uniformly. *Rhizobium* inoculation was not given either to groundnut or to intercropped legumes. The experiment received two pre-sowing irrigations in 1984 while one protective irrigation was given at 60 days growth stage at 1985 due to prolonged drought spell.

Observations at 30, 60 and 75 days after sowing were recorded on 5 randomly selected plants for nodule number and dry weight of nodules. Nitrogen content of shoot from bulk sample was estimated at 75 days growth by following micro-Kjeldhal method Pod yields of groundnut in all intercropping systems were recorded at maturity. The yields of inter-crops were not recorded.

RESULTS AND DISCUSSION

During both the years (1984 and 1985) nodule number recorded at pod filling stage were poor in groundnut when cereals were used as intercrops as compared to other intercropping systems and sole groundnut crop (Table 1). There was no marked difference in nodulation between the sole and cereal intercropped groundnut during initial stages (30 and 60 days) of crop

Table 1 Nodulation, plant dry weight and nitrogen content of groundnut (var. GG 2) under sole and intercropped situation (rainy season 1984-85)

Treatments	1984					1985				
	Nodule number / plant		Plant dry wt. (g/ plant)		N mg/ plant	Nodule number / plant		Plant dry wt. (g/ plant)		N mg/ plant
	60*	75	60	75	75	60	75	60	75	75
Groundnut+Pearl Millet	37.3	34.7	10.1	10.3	288	20.3	37.0	6.5	7.0	117
Groundnut+corn	43.4	33.0	9.1	11.4	230	21.7	36.7	6.8	6.6	115
Groundnut+Sesamum	40.9	57.6	10.6	13.8	353	25.1	54.1	7.4	8.6	178
Groundnut+Sunflower	49.9	48.3	11.4	11.9	412	29.9	54.7	7.5	8.4	159
Groundnut+Cowpea	43.6	46.4	9.1	10.0	347	25.4	56.0	7.3	8.1	148
Groundnut+Soybean	38.5	47.6	10.0	12.6	437	26.7	55.5	8.5	8.4	153
Sole Groundnut (control)	37.4	54.0	9.4	14.2	482	27.3	58.0	8.3	8.6	176
CD at 5%	8.51	9.0	1.3	1.0	—	No	13.3	0.9	0.5	—

* Days after sowing, NS Not Significant

growth. Decrease in nodule number ranged between 20-38 per cent in this intercropping system over sole groundnut crop at 75 days growth. There was no significant change on nodulation in groundnut under other intercropping combinations although slight increase in nodulation occurred in groundnut+sunflower intercropping at 60 days growth during 1984 only. Similarly under groundnut+cereal intercropping at 30 and 60 days growth plant biomass (plant dry weight) did not differ much but at 75 days growth it was significantly low over sole crop of groundnut (Table 1). Nitrogen content or shoot at 75 days growth stage in groundnut+cereal intercropping was also low in both the years.

Hundred nodule weight (which is an index of nodule size) averaged over two seasons at 75 days growth was considerably low with tall growing cereal intercropping system (Fig. 1). However, it did not differ significantly in oilseeds and legume intercropping systems over sole crop.

It is apparent from the above results that tall growing cereal intercrops significantly affected the nitrogen fixation traits in groundnut. But medium tall oilseed crops and short stature legumes did not have appreciable influence. Reduced light on groundnut consequent upon shading caused by tall growing cereals might have restricted the photosynthesis and energy supply to roots thereby reducing the nodulation and the nodule size. Restricted photosynthesis further evidenced lower biomass production. Low nitrogen content of groundnut shoot sampled from cereal intercropping system could be attributed mainly to lower nitrogen fixation and N-uptake from soil under restricted photosynthesis. Nambiar *et al.* (1983) demonstrated that intercrops like pearl-millet, corn and sorghum limited the light reaching the groundnut crop canopy to an extent of 33 per cent thereby restricted the photosynthesis. This inturn had also reflected the reduced nodulation and nitrogen fixation. Further, they also observed that when lateral leaves of sorghum crop were removed the intercropped groundnut nodulated better and fixed more nitrogen. Similar reduction in nodulation and N_2 fixation in soybean intercropped with corn was reported (Whaua and Miller, 1978). Non-sigficant differences in the nodulation in the initial stage (at 30 days growth) however could be attributed to shorter height of intercrops which apparently did not create effective shading.

Maximum nodulation and nitrogen fixation in groundnut is known to occur at the pod filling stage (Nambiar *et al*, 1986 and Kulkarni *et al.*, 1986).

Fig. 1

EFFECT OF INTERCROPPING ON NODULATION IN GROUNDNUT (GG 2)

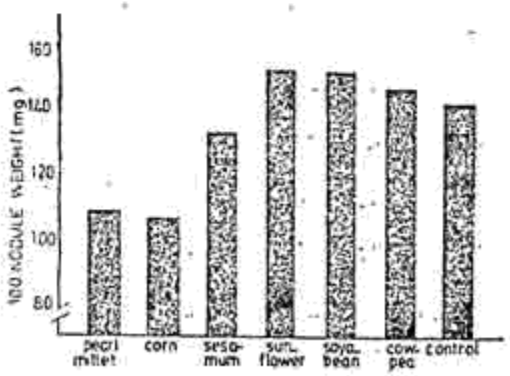

Table 2 Effect of different intercropping systems on pod yield of groundnut var. GG 2

Treatments	Pod yield kg/ha		
	1984	1985	Mean
Groundnut+Pearl Millet	1035.0	898.5	966.7
Groundnut+Corn	1196.0	866.2	1031.1
Groundnut+Sesamum	1414.0	1231.0	1322.0
Groundnut+Sunflower	1401.0	1135.0	1268.0
Groundnut+Cowpea	1420.0	1251.0	1335.5
Groundnut+Soybean	1293.0	1352.0	1309.0
Groundnut alone control	1491.0	1158.0	1324.0
CD at 5%	156.0	166.0	160.9

Thus any discrepancy in nodulation and nitrogen fixation is bound to contribute to pod yield. Hence it is clear that pod yield of groundnut was significantly affected in groundnut + cereal intercropping during both the seasons (Table 2). There was no significant difference in pod yield under groundnut + oilseed and groundnut + legume intercropping systems

Based on the above results it could be concluded that shading created by tall growing pearl millet and corn intercrops on groundnut inhibited the normal nodulation resulting in decreased pod yield. On the other hand intercrops like sesamum, sunflower, cowpea or soyabean could be ideal alternative crops in the farming systems to augment benefits of intercropping systems in India as they increased nodulation growth and pod yield in groundnut.

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