In brief, the results indicate that since wider spacing resulting in non uniform tillers, non uniform flowering and ripening, the production of HD grain is limited and therefore an optimum spacing of 20x10 cm is beneficial for future adoption in scented varieties. As higher nitrogen resulted in lodging and being non-responsive to HD grain, an optimum of 40-60 N/ha is being suggested. Further, the low HD grain index (37-47%) in scented varieties emphasises the need for focussing future thrust on grain filling.

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YIELD ATTRIBUTES AND YIELD OF N AND RHIZOBIUM INOCULATIONS IN SORGHUM - SOYBEAN INTERCROPPING

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ABSTRACT

An experiment was conducted during September to December 1986 (*rabi* season) and February to May 1987 (summer season) on sandy loam and clay loam soils respectively under irrigation at the Tamil Nadu Agricultural University, Coimbatore, to find out the effect of N and *Rhizobium* inoculations in sorghum - soybean intercropping. It was inferred that the sorghum Co26 in double paired row intercropped with soybean Col at 50 per cent of the recommended level of N (45 kg N ha^{-1}) in combination with the indigenous Rhizobial strain, *Rhizobium japonicum* soybean 53 gave the highest grain yield of sorghum and soybean with a saving of 45 kg N ha^{-1}.

KEY WORDS : Yield, *Rhizobium* inoculation, Intercropping

In India, sorghum is being grown as a sole crop, as intercrop with pulses or mixture crops to serve as an 'harvest insurance'. The compatibility of sorghum - soybean based cropping system in terms of agronomic practices, monetary returns and improvement of soil is appreciated widely. It has become evident from the recent studies that not only total yields from intercropping can be larger than those from pure stands of sorghum. (Wiley, 1979; Anon., 1981) but also a legume as an intercrop has exercised beneficial effects on the associated non legume system (Burton *et al.*, 1983) in terms of gains in grain protein and soil N fertility and its maintenance without N fertilisation (Searl *et al.*, 1981)

MATERIALS AND METHODS

The experiments, conducted during September to December 1986 (*rabi* season) and February to May 1987 (summer season) on sandy loam and clay loam soils respectively under irrigation at the Tamil Nadu Agricultural University, Coimbatore, were laid out in split plot design with four replications. The spacing adopted for sorghum Co26 between rows was 30cm as against normal 45cm and 90cm between two rows of soybean with a plant spacing of 5cm for soybean as against normal plant spacing of 15cm. The population was maintained uniformly under the sole and intercrop system. While the main plot consists of N levels, the sole plot is treated with rhizobial cultures. The treatment details are as follows:

Main Plot
N Levels

No - No nitrogen
N1 - 25 per cent of the recommended N for sorghum (22.5 kg ha^{-1})
N2 - 50 per cent of the recommended N for sorghum (45.0 kg ha^{-1})
N3 - 75 per cent of the recommended N for sorghum (67.5 kg ha^{-1})
N4 - 100 per cent of the recommended N for sorghum (90.0 kg ha^{-1})

Sub plot
Rhizobial strains

CO - Soybean uninoculated
C1 - Soybean inoculated with *Rhizobium japonicum* strains, soybean 53.
C2 - Soybean inoculated with *Bradyrhizobium japonicum* strains USDA 110.

The entire quantity of N, 45 kg ha^{-1} of P_2O_5 and K_2O each were applied basally to the base crop

Table 1. Effect of treatments on the yield and yield attributes basecrop sorghum - Co 26 intercrop soybean Co 1

Treatment	Plant height (cm)	Ear head length (cm)	Ear head width (cm)	Ear head weight (g)	Thous and grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Plant height (cm)	No. of bran ches plant^{-1}	No. of pods Plant^{-1}	No. of seeds plant^{-1}	Hundred seed weight (g)	Seeds yield kg ha^{-1}	Stover yield kg ha^{-1}
			1986 *Rabi*								1986 *Rabi*			
N0	159.76	21.41	7.46	87.79	33.10	3540	2378	52.20	3.80	11.32	15.06	8.07	128	253
N1	172.38	20.53	6.90	85.08	36.58	3556	2154	50.25	3.67	9.78	14.69	8.13	159	265
N2	179.92	24.70	9.19	103.65	45.62	4197	2445	59.25	4.33	14.28	17.03	8.68	240	180
N3	189.53	26.67	9.67	142.90	44.12	4137	2994	52.98	4.11	16.99	16.30	8.05	173	259
N4	165.61	25.30	9.02	102.58	52.88	4530	2395	56.67	3.73	10.06	13.11	8.18	145	244
S.E.	10.27	1.61	0.98	13.94	6.36	192	230	2.93	0.44	1.66	2.91	0.12	15	34
C.D. (5%)	N.S.	N.S.	N.S.	N.S.	N.S.	592	N.S.	N.S.	N.S.	5.13	N.S.	0.37	46	N.S.
C0	153.63	22.97	7.93	95.65	41.89	4057	2693	56.72	3.74	10.73	12.55	8.22	167	224
C1	174.94	23.29	8.65	106.61	40.60	4088	2257	53.09	3.87	12.42	17.62	8.17	169	222
C2	191.75	24.92	8.76	110.95	44.88	3826	2439	53.00	4.18	14.31	15.54	8.28	170	246
S.E.	6.50	0.64	0.28	4.52	2.62	219	186	1.19	0.21	0.85	1.36	0.11	9	16
C.D. (5%)	18.75	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	2.45	3.91	N.S.	N.S.	N.S.
N X C	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
			1987 Summer								1987 Summer			
N0	151.77	19.83	6.11	37.58	31.92	1802	3724	57.46	7.51	24.82	19.98	10.74	151	143
N1	156.67	21.16	6.15	41.54	30.73	2071	3666	62.31	7.70	22.47	21.62	10.89	183	182
N2	152.32	19.59	6.05	44.30	30.66	2178	3845	72.68	7.62	27.84	33.28	11.19	244	244
N3	154.43	20.15	5.59	47.81	29.96	2177	4418	64.52	7.97	29.77	34.33	11.89	244	326
N4	153.67	19.41	5.88	46.51	29.49	1982	3888	58.69	7.80	29.01	26.70	11.47	201	144
S.E.	4.93	0.85	0.24	4.29	0.73	149	348	1.87	0.70	2.40	4.94	0.27	12	35
C.D. (5%)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	5.75	N.S.	N.S.	N.S.	N.S.	37	108
C0	155.33	19.76	5.92	42.81	30.04	1942	3749	67.79	7.51	26.97	29.00	11.25	193	216
C1	154.71	20.06	6.03	43.51	30.82	2115	4114	59.64	8.05	26.99	27.03	11.34	224	203
C2	151.28	20.26	5.91	44.81	30.79	2069	3851	61.97	7.61	26.39	25.50	11.12	197	204
S.E.	2.65	0.73	0.27	2.32	0.53	108	159	2.28	0.47	2.18	3.13	0.17	7	28
C.D. (5%)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	6.58	N.S.	N.S.	N.S.	N.S.	21	N.S.
N X C	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

N.S. : Not Significant

of sorghum Co26 only. The soybean Co1 seeds were inoculated with the two *Rhizobium* strains. The sorghum Co26 and soybean Co1 were sown on 17 August 1986 and 9 February 1987 and harvested on 18 December 1986 and 3 May 1987 and *rabi* and summer season crops respectively.

RESULTS AND DISCUSSION

Sorghum base crop

The effect of N and rhizobial strains on the yield attributes, grain and straw yield are presented in Table 1 for both the seasons. It is seen that the yield attributes and grain yield were not influenced by the treatments studied but influence of season on these characters was well pronounced. The lower grain yield during summer may be due to the rainfall received between mid April 1987 to mid May 1987 which coincided with flowering and milky stage of crop resulting in flower and pollen shedding. The air temperature during summer at flowering (35.17/23.6 ^{o}C) and at grain formation (35.0/23.3 ^{o}C) might have resulted in the abortion of floral parts and sterility. Peacock and Heinrich (1962) reported that floral abortion occurs at 33/28^{o} C and even moderately high temperature at anthesis caused embryo abortion. In *rabi*, such conditions did not exist and favoured the floral setting and grains formation resulting in higher grain yield. Further the source sink relationship was higher because of low respiration and greater translocation of photosynthesis from leaf to floral parts resulting in higher grain yield in *rabi* that summer.

Neither N nor *rhizobium* cultures and their interaction was significant in both the seasons for all the characters except grain yield during *rabi* was significant. Summer straw yield was higher than *rabi* crop was raised under sandy loam soil. The higher soil moisture availability in clay loam soil to the summer crop coupled with high temperature promoted, during vegetative growth, increased straw yield. This increased vegetative growth of the base crop sorghum had its negative influence on the reproductive system resulting in lower grain yield and yield components. Similar to grain yield N2 level (45.0 kg ha) and indigenous *rhizobium* (C1 was found to perform better in summer than *rabi*).

Soybean - intercrop

The influence of N and rhizobial strains on yield attributes and yield is presented in Table 1. The yield attributes and yield were higher during summer than *rabi*. The increased seed yield in summer as against *rabi* was in proportion to the increase in yield components of the former. The N levels were significant in increasing the soybean inter crop yield in both the seasons and the application of Rhizobium in summer alone was significant. The interaction effect was not significant.

Intercropped soybean, stover yield was higher and the seed yield was lower in *rabi* and in summer it was vice-versa. Neither N nor *Rhizobium* and their interaction was significant in both the seasons, except the effect of N during summer. Of N levels, N3 (67.5 kg N ha^{-1}) gave higher stover yield during summer but did not differ from N2 level (45 kg N ha^{-1}) and in *rabi* the lower stover yield at N2 level (45 kg N ha^{-1}) would suffice for the intercrop soybean indicating that 45 kg N ha^{-1} (N2) is suffi cient for the stover yield irrespective of rhizobial application since rhizobia did not influence the stover yield.

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