Table 4. Effect of gentamycin on mean larval weight, cocoon weight, shell weight and silk filament length in *B.mori*

Treatment (ppm)	Larval weight (g)		Cocoon weight (g)		Shell weight (g)		Silk filament length (m)	
	Gentamycin	Gentamycin + NPV*	Gentamycin	Gentamycin + NPV*	Gentamycin	Gentamycin + NPV*	Gentamycin	Gentamycin + NPV*
0	3.18^{c}	2.94^{c}	1.62^{d}	1.30^{c}	0.280^{c}	0.246^{c}	679^{c}	514^{d}
12.5	3.20^{c}	3.01^{c}	1.66^{c}	1.36^{b}	0.309^{d}	0.269^{d}	733^{d}	559^{c}
25.0	3.29^{c}	3.12^{b}	1.70^{b}	1.37^{b}	0.320^{c}	0.275^{c}	741^{cd}	591^{c}
50.0	3.48^{a}	3.20^{a}	1.77^{a}	1.57^{a}	0.341^{a}	0.318^{a}	829^{a}	743^{a}
75.0	3.50^{a}	3.21^{a}	1.75^{a}	1.56^{a}	0.328^{bc}	0.317^{ab}	816^{ab}	650^{b}
100.0	3.50^{a}	3.22^{a}	1.75^{a}	1.58^{a}	0.330^{b}	0.313^{b}	779^{bc}	652^{b}
Mean	3.37	3.13	1.71	1.46	0.319	0.289	763	619

*BmNPV 100 POB/Larva Means followed by similar letters are bot different statistically (P=0.05) by L.S.D.

effective rate of rearing (ERR) of 92.26 per cent compared to the other antibiotics.

From this study it was found that mulberry leaf supplemented with 50 ppm of either tetracycline or gentamycin, once during third instar of silkworm was found effective in reducing the grasserie mortality besides enhancing the larval and cocoon parameters.

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PARTIAL SUBSTITUTION OF NITROGEN THROUGH COMBINED APPLICATION OF BIOFERTILIZERS IN RICE

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ABSTRACT

The individual and combined effect of *Azolla* and *Azospirillum* on rice was investigated both in the presence and absence of inorganic nitrogen for two seasons. At O kg N/ha level, application of *Azolla* or *Azospirillum* alone augmented the grain yield by 21 and 19 per cent respectively. However, combined application of *Azospirillum* and *Azolla* with 50 and 75 kg N levels increased the grain yield. At 100 kg N/ha, the response was relatively low.

KEY WORDS : Biofertilizers, *Azolla*, *Azospirillum*, rice

Biological nitrogen fixation plays a key role in nitrogen management. It has been reported that application of 75 kg N/ha along with *Azospirillum* increased the rice yield significantly (Subba Rao *et al.*, 1979) So far attempts were made to study the effect of biofertilizers like *Azolla*, *Azospirillum* and BGA either individually or in combination with graded levels of N. The information on the effect of combined application of *Azolla* and *Azospirillum* with different levels of N is limited. Hence, it was field tested in *Kuruvai* and *Samba* seasons and the results are reported here.

Table 1. Effect of biofertilizers in combination with inorganic nitrogen on plant height and tillers production in rice

Treatments	Plant height (cm)		Total tillers (No. /hill)		Productive tillers (No. /hill)	
	ADT 36	ADT 38	ADT 36	ADT 38	ADT 36	ADT 38
Control	75.4	83.3	8.5	7.5	7.6	6.3
Azospirillum	81.6	89.6	9.0	7.7	8.3	7.3
Azolla	81.7	89.9	9.3	7.9	8.4	6.9
Azospirillum + Azolla	83.4	88.6	9.6	8.5	[illegible]	6.6
50 Kg N/ha	84.4	87.2	9.3	9.0	9.1	6.7
75 Kg N/ha	86.7	89.9	10.1	9.3	9.4	7.3
100 Kg N/ha	88.2	90.8	10.5	9.9	9.6	7.5
50 Kg N/ha *Azospirillum + Azolla*	86.4	90.4	11.0	10.3	9.9	8.1
75 Kg N/ha *Azospirillum + Azolla*	95.2	96.2	12.5	11.4	10.7	8.5
100 Kg N/ha *Azospirillum + Azolla*	92.5	95.8	12.0	10.9	10.6	8.9
CD (P=0.05)	5.8	4.1	1.4	1.1	0.9	1.2

MATERIALS AND METHODS

The individual and combined effect of *Azolla* and *Azospirillum* was investigated in ADT 36 rice in *Kuruvai* '91 and ADT 38 in *Samba* 91 seasons. The trials were laid out in randomised block design with three replications with graded levels of N applied at 50, 75 and 100 kg N/ha. Both P and K @ [illegible] kg/ha were applied basally and N was applied in four splits *viz.*, basal as well as three tops in both the seasons. *Azospirillum* inoculation was done through seed, seedling root dip and soil application @ 600, 1000 and 2000 g/ha. Fresh fronds of *A. microphylla* was inoculatd @ 1 t/ha on 10 days after transplanting (DAT) and incorporated on 30 DAT. The plant height, total and productive tillers were recorded a week prior to harvst. The grain and straw yields were also recorded.

RESULTS AND DISCUSSION

Biofertilizer application increased the plant parameters. However, in combination with 75 kg N/ha, the increase was very much pronounced (Table 1). The increase in plant biometrics may be attributed to the production of growth promoting substances by these biofertilizers (Watanabe and Lin, 1984). The influence of biofertilizers in augmenting the grain yield varied with the N levels and seasons. The response to *Azolla* and *Azospirillum* was more pronounced in *Kuruvai(Kharif)* season that commences after a dry spell and fallowing, irrespective of whether they were applied individually or in combination with the other or with or without N fertilizers. At 0 kg N level, application of *Azospirillum* alone recorded a grain yield of 5.03 t/ha which was 19.2 per cent higher than the uninoculated control (Table 2). *Azolla* alone enhanced the grain yield by 21.7 per cent. Both these biofertilizers when applie together enhanced the grain yield by 33 per cent in *Kuruvai* season in ADT 36 rice. However, there was no marked increase in grain yield over the control due to combined application of these biofertilizers during *Samba* season at 0 kg N/ha. Among the different 'N' levels tested in *Kuruvai* season, the response was higher at 75 kg N/ha level by

Table 2. Combined application of biofertilizers with inorganic nitrogen on rice grain yield

Treatments	ADT 36		ADT 38	
	Yield (t/ha)	% increase over control	Yield (t/ha)	% increase over control
Control	4.22	-	4.88	-
Azospirillum	5.03	19.2	4.29	-
Azolla	5.18	22.7	4.59	-
Azospirillum + Azolla	5.62	33.2	4.73	-
50 Kg N/ha	5.25	24.4	5.11	4.71
75 Kg N/ha	5.70	35.1	5.40	10.65
100 Kg N/ha	6.21	47.2	5.55	13.73
50 Kg N/ha *Azospirillum + Azolla*	5.58	32.2	5.55	13.73
75 Kg N/ha *Azospirillum + Azolla*	6.43	52.4	6.62	15.2
100 Kg N/ha *Azospirillum + Azolla*	5.99	41.9	4.96	1.64
CD (P=0.05)	0.64		NS	

recording 6.43 t/ha which was 52 per cent increase over control. Similar trend was observed also in *Samba* season. However, combined application of *Azospirillum* and *Azolla* with 50 and 75 kg N/ha levels increased the grain yield. At 100 kg/ha, the response due to biofertilizer was relatively low. This is in concurrence with the earlier findings (Gopalaswamy *et al.*, 1989)

With respect to straw yield, application of *Azospirillum* or *Azolla* with and without inorganic N augmented the biomass yield. Maximum increase in straw yield was noticed when *Azospirillum* and *Azolla* were applied with 75 kg N/ha alone. The study clearly indicated that the grain yield increased when judicious combination of N with combination of biofertilizers was followed. By applying biofertilizer individually or in combination, a reduction of only 25 kg N/ha over the recommended levels can be adopted without sacrificing the grain yield.

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COMPARISON OF SINGLE AND THREE-WAY CROSSES IN GROUNDNUT

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ABSTRACT

Comparison of parents, single crosses and three-way crosses in groundnut revealed that high level of heterotic effects were observed in single crosses for the traits : number of branches, number of mature pods and pod yield. The three-way crosses exhibited heterotic effects for shelling out turn, pod weight and kernel weight. Hence for the improvement of these traits three-way crosses may yield better results than single crosses. The range of mean values was narrow in three-way crosses for four of six traits studied, which suggests that the three-way crosses have more buffering capacity than single crosses.

KEY WORDS : Groundnut, single cross, three-way cross, heterosis

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop grown under diversified climatic conditions both under rainfed and irrigated situations. There is a need to broaden the initial genetic base to achieve stability in yield as the three-way and double crosses in maize were known to be stable and high yielding over environments (Weatherspoon, 1970).

In this process, three-way crosses are the next logical step to single crosses. However, multiple crosses are not common in groundnut. Hence, in the present study, an attempt was made to compare single and three-way crosses to find out their suitability.

MATERIALS AND METHODS

Six cultigens *viz* ., ICGS 44 (P1), Girnar 1 (P_2), ALR 2 (P_3), JL 24 (P_4), GG 2 (P_5) and Co 2 (P_6) (Table 1) were used in producing 15 single crosses, besides 20 three-way crosses were made ignoring the order of the parent at grand parent and parental level. For example, cross (1 x 2) x 3 was made ignoring crosses (1 x 3) x 2 and (2 x 3) x 1. Six parents, 15 F_1s and 20 three-way crosses were grown in a randomised complete block design replicated thrice during *Kharif* 93 season at the Regional Research Station, Vridhachalam. Each entry was grown in five rows of 5 m length with a spacing of 30 cm between rows and 15 cm between plants. All the package of practices was followed. Observations on six characters *viz*., number of branches, number of mature pods, 20 pod weight (g), 20 kernel weight (g), pod yield (g) and shelling out turn (%) were recorded from 10 representative plants in each entry in each replication and means were computed.