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EFFECT OF MAJOR NUTRIENTS, SALT STRESS AND TEMPERATURE ON NODULATION AND NITROGENASE ACTIVITY OF *Sesbania rostrata*

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ABSTRACT

The effect of major nutrients, salt stress and temperature on the nodule number and nitrogenase activity were studied with *Sesbania rostrata*. Different levels of NPK (25, 50 and 75 kg/ha), NaCl (0.5, 1.0 and 1.5 and 2.0 per cent) and temperature (20, 25, 30 and 35° C) were attempted. *Sesbania rostrata* responded significantly to NPK at 75 kg/ha compared to 25 and 50 kg/ha levels and control Application of NaCl irrespective of the level resulted in the lower number of nodules and nitrogenase activity. The highest number of nodules and nitrogenase activity was observed when *S. rostrata* exposed to 30°C.

KEY WORDS: Sesbania rostrata, Stress condition, Nodulation

Biological nitrogen fixation is a cheap source to complement the inorganic nitrogen requirement of a crop. Biological nitrogen fixation plays a key role in maintaining soil fertility in tropics. Legume - rhizobium symbiosis occupies major portion in biological nitrogen fixation. Most nitrogen fixing legumes have nodules on their root system, however, some species possess nodules on the stem as well as roots and they are called as stem nodulating legumes. Several of these plants viz. Sesbania, Aeschynomene and Neptunia are not only characterized by an usually good nitrogen fixing potential but also have unique capacity to absorb combined nitrogen through their roots. They can also fix nitrogen through their stem nodules, even in the presence of high soil mineral nitrogen. *Sesbania rostrata* is an annual plant thrives well in flooded conditions and has rich nitrogen

Table 1. Effect of NPK on the nodule number and nitrogenase activity of *S. rostrata*

Levels of NPK (kg/ha)	Number of stem nodules			Nitrogenase activity* of stem nodules		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
Control	26.60	29.10	23.55	121.22	132.65	138.91
N						
25	28.82	35.05	31.24	131.12	146.91	148.28
50	30.15	35.31	34.20	142.62	153.81	158.09
75	34.20	37.07	40.34	136.76	138.02	140.18
P						
25	30.62	35.38	31.23	136.42	139.66	140.18
50	33.43	37.92	32.18	146.36	152.76	157.97
75	34.64	40.23	37.08	156.28	168.35	171.91
K						
25	31.20	32.31	32.64	137.15	142.63	146.81
50	34.45	34.63	35.82	154.38	162.73	168.85
75	36.22	36.63	36.96	171.36	173.85	180.46
CD (p=0.05)	1.20	1.52	1.82	1.07	0.26	1.68

*nm ethylene produced/hr/g of nodule

in the stem nodules (Dreyfus and Dommergues, 1981).

MATERIALS AND METHODS

To know the effect of major nutrients, salt stress and temperature on the stem nodules and nitrogenase activity of *s.rostrata*, two field experiments and one laboratory experiment were conducted. I Experiment : A field experiment was carried out with major nutrients N, P and K at graded levels *viz.*, 0, 25, 50 and 75 kg/ha. They were applied basally as Urea, Super Phosphate and

Table 2 Effect of salt stress on the nodule number and nitrogenase activity of *S. rostrata*

Concentration of NaCl in %	Number of stem nodules			Nitrogenase activity* of stem nodules		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
Control	32.01	43.37	55.21	54.12	90.01	104.58
0.5	28.72	42.54	48.53	83.45	89.77	102.18
1.0	26.31	36.99	44.55	80.43	85.98	99.31
1.5	23.70	31.71	43.46	71.21	82.57	96.50
2.0	20.57	30.37	39.63	68.88	80.47	81.75
CD (p=0.05)	1.55	0.79	1.23	1.24	1.12	1.11

* nm ethylean produced/hr/g of nodule

Potash respectively. II Experiment : To know the effect of salt stress on nodulation and nitrogenase activity, another field experiment was conducted by applying NaCl in different levels *viz*, 0, 0.5, 1.0, 1.5 and 2.0 per cent. The NaCl was applied basally before sowing. III Experiment : In the lab experiment, *S.rostrata* plants were exposed to different temperatures *viz*, 20, 25, 30 and 35°C . Three sets of *S. rostrata* plants were maintained separately in the incubators each at 20, 25 and 35°C throughout the study period. Another set of plants *S. rostrata* plants were kept at room temperature (30°C).

These experiments were laid out in randomised block design. The field experiments were conducted in a clayey loam soil with a mean pH 7.5, CEC 36 meq/100 g, organic carbon 0.75 per cent, total nitrogen 0.13 per cent, 70 kg/ha available phosphorus and 92 kg/ha exchangable potassium. The nodule number was calculated and nitrogenase activity was measured by Acetylene Reduction Assay (Hardy *et al.*, 1968).

RESULTS AND DISCUSSION

The studies clearly revealed the application of major nutrients *viz*. N,P,K increased the stem nodule number and nitrogenase activity of *S. rostrata*. Application of nitrogenous fertiliser in the form of urea at 75 kg/ha level recorded higher stem nodule number (40.34) and nitrogenase activity (140.18) whereas, the control recorded the nodule number of 23.55 and nitrogenase activity of 138.91 cm C_2H_4/hr/g of nodules only. Phosphorus and potash applied treatment were also recorded higher number of nodules and nitrogenase activity compared to control (Table 1). Application of NPK at 75 kg/ha level recorded higher number of nodules and nitrogenase activity (ARA) when compared to 25 and 50 kg levels and without NPK applied treatment (control). It was clear that application of NPK upto 75 kg/ha favoured higher number of healthy nodules and thereby increase the nitrogenase activity. Sundaram *et al.*, (1991) reported that application of inorganic nitrogen upto 100 kg/ha increased the number of stem nodules. An increase in nodule number and ARA after P application has been reported by Jakobsen (1985). Graham and Rosas (1979) reported that increase in nodulation and nitrogenase activity due to K application.

The increase in sodium chloride application ranging from 0 to 2.0 per cent levels showed proportionate decrease in the production of stem nodules and nitrogenase activity of *S. rostrata*. The control recorded (without NaCl application) the higher number of nodules (55.24) and nitrogenase activity (104.66 nm C_2H_4/hr/g of nodules), whereas 2.0 per cent NaCl applied treatment recorded lower umber of nodules (39.78) and nitrogenase activity (81.80 nm C_2H_4/hr/g of nodules) (Table 2). Salt stress decreases the ARA of legume nodules. The indirect effect such as the changes in the internal structure of the nodule and inadequate supply of photosynthates to the N

Table 3. Effect of temperature on the nodule number and nitrogenase activity of *S. rostrata*

Levels of temperature	Number of stem nodules			Nitrogenase activity* of stem nodules		
	15th day	30th day	45th day	15th day	30th day	45th day
20°C	21.34	22.52	26.02	98.75	100.83	126.29
25°C	24.10	27.86	28.01	121.68	123.74	128.51
30°C	29.27	31.23	29.88	135.28	137.83	143.06
35°C	25.54	30.50	27.64	122.53	126.74	131.54
CD (p=0.05)	1.57	1.47	1.92	1.71	1.72	1.98

* nm ethylean produced/hr/g of nodule

fixing sites created by salt stress, also reduces the ARA and the results were in confirmity with the report of Sprent (1972). Graham and Parker (1964) have shown that concentration of NaCl as high as 2 0 per cent and as low as 0.2 per cent did not favour the growth of the fast and slow growing rhizobia.

The *S. rostrata* were found to record higher number of nodules (30.05 per plant) at 30°C (Table 3). Similar results were also reported by Graham (1979), where the noticed moderate day-night temperature (30-20°C) gives good early nodulation and biological nitrogen fixation. Favourable temperature for multiplication of most species of rhizobium was upto 30°C, above or below which there was sharp decline in growth (Bhriguvanshi and Gangwar, 1984).

In the present study, it was observed that stem nodulation and stem nodule nitrogenase activity was enhanced with the application of NPK upto 75 kg/ha. The increase in levels of NaCl concentration proportionately decreased the stem nodule number and nitrogenase activity of *S. rostrata*. Higher number of nodules and nitrogenase activity was observed in the *S. rostrata* when exposed to 30° C and below or above which, a decline was noticed.

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EFFECTS OF DIFFERENT PLANT DENSITY MODELS ON GROWTH AND FLOWERING OF POINTED GOURD, *Trichosanthes dioica* Roxb.

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ABSTRACT

Field experiment was carried out on the effects of different plant density models on growth and yield of pointed gourd. Three spacings (90cm,120cm,150cm) and 4 densities (5,10,15,20) of female plants from a male plant were tested during the period of study. A local variety of pointed gourd "Bhubaneswar Local" was taken for study. Among different distances tried 150cm was proved to be the most effective than that of 90 cm and 120 cm. As regards to female plant density,15 plants around one male was found to be best. Increasing the female plant population beyond 15 around one male was found to be best Increasing the female plant population beyond 15 around one male resulted in significant reduction in the yield per hectare in this crop.

KEY WORDS: Plant density, Model, Pointed Gourd