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Elucidating the role of biostimulants on seedling characters of cowpea

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ABSTRACT : An experiment was conducted to study the effect of biostimulant, *NovoBac* on seedling characters of cowpea using roll towel method. The results observed from the study revealed that seed treatment with *NovoBac* @ 1g/kg has higher shoot length, root length, dry matter production and vigour index when compared with control. The increase was due to the effect of bacteria in *NovoBac* which produce growth hormones influence growth activities of cowpea.

KEY **W**ORDS : Cowpea, Bioinoculants, Germination

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Pulses, the richest sources of protein and amino acids constitute a balanced diet. Among the pulses, cowpea [*Vigna unguiculata* (L.) Walp.] is one of the most important food crops in the semi-arid tropics. It is cultivated primarily for seeds, but also as a vegetable (for leafy greens, green pods, fresh shelled green peas, and shelled dried peas), a cover crop and a fodder. It is a warm-season, annual, herbaceous legume. In India, cowpea is cultivated in an area of 3 lakh ha with production of 2 lakh tones and productivity falls around 25t ha^{-1}during 2013 (*www.dacnet.nic.in.*). In Tamil Nadu, cowpea is grown in 1.2 lakh ha with a production of 0.25 lakh tonnes and the productivity is very low with 205 kg ha^{-1}. The productivity of vegetable cowpea is very low due to the effect of suppression of micro-organisms on plants by heavy application of fertilizers in the soil which causes toxic effect. Biostimulants contain neither fertilizer nor pesticide, but possess biologically active substances which when applied to a plant will enhance the health and growth of the plant and are often used as supplements in present day agricultural practices. Beneficial bacteria plays an important role in crop growth and development. *Bacillus amyloliquefaciens* was used to enhance the growth of several vegetable transplant systems (Kenney *et al.*, 1999). *B. amyloliquefaciens* and *B. subtilis* have strong growth-promoting activity. *NovoBac* a combination of *Bacillus* spp. bacteria is a new bioinoculants promoted by Novozymes South Asia, Bangalore. It can be applied as seed treatment, soil drenching and drip or direct to soil media and also as fertilizer. The composition of *NovoBac* includes the following inoculant micro-organisms amounting to a minimum of 8.5 x 10^9 cfu/g. With this background, the present investigation was carried out to find out the effect of bioinocualnt (*NovoBac*) as seed treatment on seedling characters of cowpea.

RESEARCH PROCEDURE

The present investigation was done to standardize the optimum concentration of *NovoBac* for seed germination of cowpea (VBN 2). The cowpea seeds were treated with different biostimulants *viz.*, T_1- Control,

T_2- *Trichoderma viride* @ 4g/kg, T_3- *Rhizobium*+ *Phosphobacteria* @ 25g/kg, T_4-*NovoBac* @ 1g/kg and T_5- *NovoBac* @ 2g/kg. Seedling characters such as shoot length (cm), root length (cm), dry matter production (g plant^{-1}) and vigour index were assessed following roll towel method (Abdul-Bakki and Anderson, 1970). The data observed were compiled and statistical analysis was carried out under Completely Randomized Design as suggested by Gomez and Gomez (1984).

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Shoot length :

Highest shoot length (18.94cm) was observed in *NovoBac* @ 1g/kg followed by *Rhizobium*+ *Phosphobacteria* @ 25g/kg (16.74cm). The lowest value was observed in control (13.43cm). The increase in shoot length with single inoculation of *Rhizobium* compared to uninoculated plant was due to production of IAA and GA which helps in cell division and cell expansion for the growth (Kaya *et al.*, 2006). These results are line with the reports of Muthukumar *et al*. (2001) who stated that, inoculated seedlings had greater shoot length as compared to control. *Rhizobium* inoculation significantly affected the plant height. Hoque and Haq (1994) found that inoculation of seed with *Rhizobium* significantly increase plant height of lentil. The increase in plant height of *NovoBac inoculated* plants might be due to the stimulatory effects of microbe induced growth regulators *i.e.*, IAA and GA as reported by Rabie (1996).

Root length :

Higher root length (19.8 cm) was reported in *NovoBac*@ 1g/kg followed by *NovoBac* @ 2g/kg (18.3cm) which was at par with *Rhizobium* + *Phosphobacteria* @ 25g/kg (18.2cm). The lower value was observed in control (15.4cm). The root development was due to the production of auxin and mineralization of nutrients by PGPR (Steenhoudt and Vanderleyden, 2000). The colonization of *Rhizobium* helps in hormonal synthesis which has direct role in root development with lateral root formation (Bhattacharyya and Pati, 2000). Increase in root length is due to accumulation of cytokinin in root.

Dry matter production :

The data on TDMA (g plant^{-1}) of cowpea variety VBN 2 as influenced by biostimulant *(NovoBac)* at seedling stage is presented in Table 1. It was observed that seed treatment with *NovoBac*@ 1g/kg had maximum dry matter of 0.0034g and minimum was observed in control with the value of 0.0024g. These results are in support of Alagawadi and Gaur (1988) that inoculation of plant with microbes increases dry matter content. Inoculation of *Rhizobial* strain isolated from Naran (Northern areas of Pakistan) showed increased root and shoot dry weight (Kumar *et al.*, 2004).

Vigour index :

Vigour index is another important parameter, which is the synthetical evaluation of the seed germination. The higher the vigour index, stronger the seeds. Highest vigour index (3.17) was registered in *NovoBac* @ 1g/kg. The control recorded lower vigour index (1.83). Inoculating *Rhizobium* strains promoted the germination and early development of bush bean seeds, which would lay a good foundation for the seedling growth (Khalequzzaman and Hossain, 2008). The increased vigour index in *NovoBac* indicates the ability of the isolates to colonize the roots of the bean plants. The results are in line with the of findings

Table 1: Effect of biostimulants on seedling characters of cowpea

Treatments	Root length (cm)	Shoot length (cm)	DMP (g)	Vigour index
T_1 : Control	15.4	13.43	0.024	1.83
T_2 : *Trichoderma viride* @ 4g/kg	16.9	13.67	0.025	1.91
T_3 : *Rhizobium*+*Phosphobacteria* @ 25g/kg	18.2	16.57	0.026	2.22
T_4 : *NovoBac* @ 1g/kg	19.8	18.94	0.034	3.17
T_5 : *NovoBac* @ 2g/kg	18.3	16.74	0.031	2.95
Mean	17.72	15.87	0.027	2.41
S.E.±	0.12	0.12	0.001	0.14
C.D. (P=0.05)	0.27	0.29	0.004	0.33

Bharathi *et al.* (2004) in chillies with the combination treatment, *viz., Pseudomonas fluorescence* + *B. subtilis*+ neem + chitin showed the highest seedling vigour.

Conclusion :

From the study, it was observed that seed treatment with *NovoBac* @ 1g/kg was found to be effective in improving seed germination than comparing with other treatments.

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