

Effect of Bioregulators on Soybean Productivity under Rainfed Conditions

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Abstract

A field experiment was conducted to assess the effect of various bioregulators and their application stages on productivity of soybean under rainfed condition during *kharif* season of 2006 to 2008. Experiment was laid out in factorial randomized block design replicated thrice with four bioregulators i.e. salicylic acid at 50 ppm, ethrel at 200 ppm, cycocel at 500 ppm and water spray (control) and three application stages i. e. flower initiation, pod initiation and flower initiation + pod initiation. Significant increase in growth parameter and yield attributes viz. leaf area index, dry matter production, pods per plant, grain and yield were observed with the application of ethrel at 200 ppm which was closely followed by cycocel at 500 ppm. Application stages of bioregulators did not differ significantly ; however, application of bioregulators at flowering + pod initiation stage recorded the highest values of growth parameter and yield.

Key words : Bioregulators, Application stages, Ethrel, Soybean, Economics.

Soybean (*Glycine max* (L.) Merrill) has emerged as one of the major oilseed crops of India. In spite of its high yield potential (4.5 tonnes/ha), soybean probean productivity is much less in India (0.95 tonne/ha) than the world average of 2.3 tonne/ha (1). Among the factors responsible for low productivity higher vegetative growth and less fruiting is one of the important constraints of soybean productivity particularly in north eastern region of India. Bioregulators are organic compounds that, in low concentrations, inhibit, promote or modify the morphological and physiological processes of plants. These natural or synthetic substances can be applied directly to the plants (leaves, fruit and seeds), provoking alterations of vital and structural processes to increase yield. Through these substances, it is possible to interfere with several physiological and morphological processes, including germination and vegetative growth, among other features. Agricultural application of bioregulators is becoming a useful practice that has improved the yield of beans, corn and soybeans. These substances, when applied in low concentrations to seeds or the aerial parts of plants, enhance the performance of vital physiological processes, exerting a positive influence on crop yield (2).

Methods

A field experiment was conducted at agronomical farm of Birsa Agricultural University, Ranchi during

Kharif of 2006, 2007 and 2008 to study the performance of some bioregulators and their stages of application on soybean (cv JS 335). The experimental soil was sandy loam in texture and slightly acidic in reaction (pH 5.9), low in available N and P and medium in K. The experiment consisted of four bioregulators i. e. salicylic acid at 50 ppm, ethrel at 200 ppm, cycocel at 500 ppm and water spray (control) and three stages of application i. e. flower initiation, pod initiation and flower initiation + pod initiation altogether 12 treatments were tested in factorial randomized block design replicated thrice to avoid any effect of heterogeneity and the treatments were randomly allocated based on standard procedure. The soybean crop was raised 45 cm with uniform fertilizer dose of 20 : 60 : 40 kg N : P₂O₅ and K₂O/ha applied as basal to all the treatments. Since data followed the homogeneity test, pooling was done over the seasons and mean data were given.

Results and Discussion

Growth and Yield Attributes

Growth parameters i.e. plant height, LAI and dry matter production (Table 1) and yield attributes i. e. pods/plant, seeds/pods and 100 seed weight (Table 2) differed significantly due to different treatments. Maximum plant height, LAI and dry matter production were recorded with the application of ethrel at 200 ppm which was significantly superior to control

Table 1. Effect of bioregulators and their application stages on plant height, branches/plant, LAI, and dry matter (pooled data of 3 years).

Treatments	Plant height (cm)	Branches/plant	LAI at pod formation	Dry matter at 45 DAS (g/plant)	Dry matter at harvest (g/plant)
Bio-regulators (ppm)					
Salicylic acid 50	71.79	4.85	3.88	10.77	19.04
Ethrel 200	71.48	5.08	3.91	10.76	20.20
Cycocel 500	70.49	4.95	3.91	10.68	19.07
Water spray (control)	70.34	4.75	3.74	10.41	17.43
SE ±	0.81	0.11	0.05	0.16	0.38
CD (<i>P</i> = 0.05)	2.37	0.33	0.15	NS	1.10
Application stages					
Flower initiation	70.78	4.94	3.84	10.62	18.90
Pod initiation	70.65	4.80	3.80	10.67	18.26
Flower initiation + Pod initiation	71.65	4.98	3.93	10.67	19.65
SE ±	0.70	0.10	0.04	0.14	0.33
CD (<i>P</i> = 0.05)	NS	NS	0.13	NS	0.95

(water spray) but at par with others bioregulators. Ethrel application at 200 ppm resulted in significantly higher number of pods/plant and 100 seed weight as compared to control. Similar findings were also reported earlier (3). Application stages failed to make any significant effect on growth parameters and yield attributes. However, maximum values of these param-

eters were obtained with application of bioregulators at flowering + pod initiation stage.

Yield and Economics

Bioregulators application leads to significant increase in grain yield and the maximum value was ob-

Table 2. Effect of bioregulators and their application stages on pods/plant, seeds/pod, 100 seed wt, grain yield, straw yield, net returns and B : C ratio (pooled data of 3 years).

Treatments	Pods plant	Seeds/pod	100 Seed wt (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Net returns (Rs/ha)	B : C ratio
Bioregulators (ppm)							
Salicylic acid 50	37.56	3.00	11.06	2206	2638	14504	2.49
Ethrel 200	39.89	3.00	11.20	2241	2737	15023	2.56
Cycocel 500	38.89	2.97	11.10	2238	2655	14816	2.51
Water spray (control)	37.44	2.95	10.45	2114	2559	14354	2.62
SE ±	0.70	0.05	0.21	30	50	331.97	0.03
CD (<i>P</i> = 0.05)	2.05	0.14	0.62	89	148	973.70	0.10
Application Stage							
Flower initiation	38.07	2.95	10.87	2185	2626	14714	2.58
Pod initiation	37.75	2.95	10.77	2167	2552	14520	2.56
Flower initiation + Pod initiation	38.92	3.03	11.21	2246	2764	14789	2.49
SE ±	0.61	0.04	0.18	26	44	287.50	0.03
CD (<i>P</i> = 0.05)	1.78	0.12	0.54	77	128	843.25	0.09

tained with ethrel applied at 200 ppm (2,241 kg/ha) which was significantly superior to control but was at par with other bio regulators similar trends were also recorded in straw yield and the minimum grain yield (2,114 kg/ ha) was obtained with water spray (control). The highest net returns (Rs 15023) and benefit cost ratio (2.56) was obtained with ethrel applied at 200 ppm which was closely followed by cycocel applied at 500 ppm. The findings were in close conformity with that of Arora et al. (4). Application stage did not differ significantly in respect of yield and economics but the highest value was recorded with bioregulators applied at flowering + pod initiation stage.

From three years of study, it is concluded that application of ethrel at 200 ppm at flowering + pod

initiation stage along with recommended dose of N-P-K fertilizers (20 : 60 : 40 kg/ha) is promising for productivity of soybean under rainfed condition.

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