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Original Research Article

Effect of Bio control Agent on Morphological and Yield Attribute Aspects of Wal (*Lablab purpureus* L.)

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A B S T R A C T

The field experiment was conducted at education and research farm, Dept. of Agril. Botany, College of Agriculture, Dapoli during *rabi* 2017-2018 to study effect of biocontrol agents on physiochemical aspects of Wal (*Lablab purpureus* L). The experiment laid out in randomized block design with seven treatments randomized in three replications. The apllied seven treatment *VIZ* T_0 -RDF only, T_1- Rhizobium treatment, T_2 -RDF+ T_1, T_3 -*Tricoderma viride* (4ml/lit)+ T_1, T_4- *Pseudomonas fluorescence* (4ml/lit)+ T_1, T_5 - *Bacillus subtilis* (4ml/lit)+ T_1, T_6 -*Paceilomyces lilacinus* (4ml/lit)+ T_1 respectively. Different bio control agents were applied through foliar spray at 2^{st} and 4^{th} week after sowing. Data were collected on plant height, number of branches, number of leaves, days to 50% flowering, days to maturity, number of pods per plant, no of pods per plant, no of grains per pod, pod yield per plant(g), pod yield per plot(kg), grain yield per plant(g), grain yield per plot(g) at the interval of 30, 60, 90 DAS and at physiological maturity. Growth period of the crop significantly reduced with the application of bio control agent. The treatment paceilomyces lilacinus *Bacillus subtilis Pseudomonas fluorescence* and *Trichoderma harzianum* were superior in physiological attributes and growth parameter among all the treatments. So there is a need of further research work on different bio-control agents to assess their potential for developing pollution free smart green technologies in agriculture. Physiological role of biocontrol agent in mitigating the morphological related consequences of crop are discussed.

Introduction

Lablab bean (*Lablab purpureus L.*) is an ancient legume crop widely grown throughout the world for its vegetable or pulse for human consumption or used as a cover crop (Mureithi *et al.*, 2003). The plant is variable due to wide genetic variation in cultivation, but in general, they are annual or short-lived perennial vines. It is popularly known as 'Wal' in Maharashtra state. India ranks first in the world in terms of pulse production (25 per cent total worlds production) (FAOSTAT, 2015). In India, the area under *Rabi* pulses cultivation was 190.4 lakh hectares with 124 lakh tones total production of pulses and productivity was 651.2 kg per hectare (Anon., 2015). Maharashtra had 1,125 thousand hectare area and 2,268 million tonnes total pulses production with 743 kg per hectare productivity of pulses (Anonymous, 2014). Yield is a complex trait governed by many traits and there are ample evidences to show that selections directly for grain yield in plants are not easy. The basic studies on the basis of morphophysiological traits are needed to overcome the yield barriers within the genotypes. It is ultimately the morpho-physiological variations, which is important for realizing higher productivity as evident from very high and positive association within traits. The present investigation was, therefore, undertaken to assess the physio-morphological variability among collected genotypes. Bio-control agents are often used for the controlling pest and diseases. But the potential of bio-control agents for improvisation of physiological, biochemical and quality aspects in different pulses is yet to understood in systematic and scientific manner. Induced systemic resistance (ISR) is the ability of an agent (a fungus, bacteria, virus, chemical etc.) to induce plant defense mechanisms that lead to systemic resistance to a number of pathogens.

Materials and Methods

The field experiment was conducted at Education and Research Farm, Dept. of Agril. Botany, College of agriculture, Dapoli during *rabi* 2017-18. Variety of wal kokan wal-2 was selected for study with seven treatments and three replication.

Bio-controls were procured from the Krishi Vigyan Kendra Baramati Dist. Pune and utilize in the experiment. Seeds of wal variety, kokan wal-2 were taken from the Department of Agril. Botany, Dapoli. Sowing was done at the spacing of 30×30 cm. Thinning was done 10 days after sowing to retain one plant per hill. Five plants were randomly selected in each genotype and replication. Various morphological characters viz. plant height (cm), number of branches, number of leaves, days to 50% flowering, days to maturity and yield parameters were studied. Critical differences were calculated at five per cent level of significance. Based on the results, high yielding treatments were identified (Table 1).

Results and Discussions

On this pretext improvement in yield level through smart culture management and judicious use of resources occupy a significant position. The smart move of crop improvement is possible through application of bio-control agents on wal during early vegetative growth. Till to date bio-control agents have the identity as ecofriendly regulator for pest and diseases. But least is thought about their abilities to crop improvement. These bio-control agents are bacteria and fungi observed in micro fauna of the ecosystem and their role in various natural phenomenon is unequivocal.

All the different bio control agent treatment was studied for different morphological characters. The vegetative phase governs the overall phenotypic expression of the plant and prepares the plant for next important reproductive phase. Treatments differed in various morphological characters such as plant height, number of branches, number of leaves, days to 50% flowering and days to physiological maturity. The plant height is one of the important characteristic. Data indicated that plant height increased continuously from 30 days after sowing to harvest and the increase in height was more between 30 to 60 days after sowing as compared to other stages (Table 2). The results are in accordance with Kleifeld *et al.,* (1992). In present investigation, the number of branches per plant was found to increase continuously with the advancing age of the crop (Table 3). Among all treatments, T_6 (7.22) performed better for number of branches followed by T_5 (6.778). The size of photosynthetic apparatus depends upon the number of leaves of the plant. Maximum numbers of leaves were found during 90 days after sowing (Table 4). At harvesting, maximum number of leaves was found in treatment T_6 (32.67). In present investigation it was found that treatment significantly differed in days to 50 per cent flowering. Some bio-control agent treatment shows early flowering *viz.* T_6 (63.33) showed lowest days to 50 per cent flowering. Generally it was noted that 50 per cent flowering was achieved during $2/3^{rd}$ of the life of the crop. The bio control agent as well as environmental conditions also has selective influence on flowering. Days to maturity ranged between 116.67 and 110. Treatment T_6 was earliest maturing treatment while treatment T_0 matured very late (Table 5).

To plant physiologist, it is the net economic gain from the source and sink capacity. Number of pods per plant is important character which has maximum direct effect over pod yield per plant Number of pods per plant is important character which has maximum direct effect over pod yield per plant. In present investigation, it was observed that there was large variation between treatments for number of pods per plant (Table 6). The number of pods per plant ranged between 31.778 and 24.556 which clearly indicate that there was wide variation. Similarly, pod weight per plant also varied and maximum pod weight per plant was found in treatment T_6 (19.311g) which was significantly superior to all other treatments. Pod yield per plant depends upon 100 seed weight and number of pods per plant. Number of seeds per pod there is no such variation among treatments. Seed yield per plant ranged between 13.737 and 8.553.there was significant variation observed among the treatments. Treatments T_6 is superior among all the treatments. Similar result in ground nut obtained by Banerjee *et al.*, (2017).

Pod yield per plot was found highest in T_6 (1.260 kg) (Table 6) and its yield was 772.45 g (Table 7) which was highest among all the treatments. In case of treatment T_6, due to spraying of bio control agent the plant population is optimum so there is increasing seed yield than the other treatments.

Table.1 Treatments details

Treatments	**Treatment Name**
T_0	RDF only
T_1	*Rhizobium* treatment only
T_2	RDF + *Rhizobium* treatment only (T_1)
T_3	*Tricoderma harzianum* (4ml/lit) + *Rhizobium* treatment only(T_1)
T_4	*Pseudomonas fluorescnce* (4ml/lit) + *Rhizobium* treatment only (T_1)
T_5	*Bacillus subtilis* (4ml/lit) + *Rhizobium* treatment only (T_1)
T_6	*pacilomycese lilacinus* (4ml/lit) + *Rhizobium* treatment only (T_1)

Table.2 Performance of different treatment of bio control agent on lablab bean for plant height

Mean plant height (cm)				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	20.56	57.22	77.78	81.44
T_1	20.78	58.44	80.33	82.44
T_2	21.11	59.44	80.89	84.22
T_3	22.11	60.22	81.78	84.89
T_4	22.44	60.56	81.89	85.11
T_5	22.56	60.56	82.11	85.78
T_6	23.11	66.22	89.22	92.89
S.Em±	0.464	2.400	2.390	2.640
CD at 5%	1.430	7.396	7.363	8.136

Table.3 Performance of different treatment of bio control agent on lablab bean for no. branches

Mean Number Branches			
Treatments	**30 DAS**	**60 DAS**	**90 DAS**
T_0	0.778	3.333	6.000
T_1	0.889	3.444	6.111
T_2	0.889	3.556	6.111
T_3	0.889	3.778	6.556
T_4	0.889	3.889	6.667
T_5	1.000	4.000	6.778
T_6	1.000	4.333	7.222
S.Em±	0.104	0.202	0.240
CD at 5%	NS	0.623	0.740

Table.4 Performance of treatment of bio-control agent on lablab bean for number of leaves

Mean number of leaves per plant				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	13.00	37.44	51.89	27.78
T_1	13.56	38.44	52.11	28.11
T_2	14.00	38.89	52.33	27.89
T_3	15.44	40.67	53.78	28.56
T_4	15.33	40.67	54.78	28.67
T_5	15.78	41.00	56.44	30.67
T_6	16.67	42.78	59.11	32.67
S.Em±	0.58	0.70	1.90	1.44
CD at 5%	1.80	2.15	5.86	4.43

Table.5 Performance of different treatment of bio-control agent on lablab bean for flowering and days to physiological maturity

Treatments	50% flowering	Maturity
T_0	66.00	116.67
T_1	64.33	113.67
T_2	63.66	113.33
T_3	64.66	110.33
T_4	65.33	115.00
T_5	65.33	110.67
T_6	63.33	110.00
S.Em±	1.54	2.03
CD at 5%	4.75	6.26

Table.6 Performance of different treatment of bio control agent on lablab bean for yield attributes

Yield and Yield parameter					
Treatment	**No. of Pod/ plant**	**No. of seed/pod**	**pod yield/ plant (gm)**	**pod yield/ plot (kg)**	**Seed yield/ plant**
T_0	**24.556**	**3.444**	**11.333**	**0.815**	**8.533**
T_1	**25.778**	**3.444**	**10.500**	**0.903**	**9.015**
T_2	**27.333**	**3.556**	**12.333**	**0.980**	**9.894**
T_3	**30.444**	**3.667**	**14.211**	**1.103**	**10.262**
T_4	**29.556**	**3.778**	**15.667**	**1.110**	**11.853**
T_5	**30.889**	**4.000**	**17.722**	**1.183**	**10.899**
T_6	**31.778**	**4.333**	**19.311**	**1.260**	**13.737**
S.Em±	**0.491**	**0.136**	**0.730**	**0.052**	**0.305**
CD at 5%	**1.51**	**NS**	**2.25**	**0.161**	**0.940**

Table.7 Performance of different treatment of bio-control agent on lablab bean for yield and harvest index

Treatment	Seed yield/ plot (gm)	Harvest index (%)
T_0	510.17	29.13
T_1	587.5	33.55
T_2	593.5	33.89
T_3	625.83	35.87
T_4	679.67	38.91
T_5	652.17	37.24
T_6	772.45	44.01
S.Em±	35.41	2.64
CD at 5%	109.13	8.14

The decrease in seed yield as compared to pod yield is due to less recovery of seeds from pods (60%). The range of seed yield in between treatments was 772.45 g to 510.17 g which clearly indicates that there was wide variation among treatments for seed yield due to the plant population. Maximum seed yield was obtained in treatment T_6 (772.45 g) which was having optimum values for all other physiological characters. Treatment T_0 recorded 510.17 g seed yield per plot which was minimum among all the treatments. It is clearly seen that the sink capacity also varied among the treatments that ultimately reflected in variation in yield. Similar result in ground nut obtained by Banerjee *et al.,* (2017).

Harvest index is the ratio of economic yield to the total biological yield. It depends upon relative duration of vegetative and reproductive period. In present investigation, it was observed that treatments varied among themselves for harvest index (Table 7). Maximum harvest index was recorded in treatment T_6 (44.01%) because ratio of seeds to total dry matter was high. The range of harvest index in treatments is 29.13 to 44.01 per cent which indicates that there is wide variation between all the treatments. Similar results in green gram were reported by Sripriaya *et al.,* (2005).

It is concluded that, the physiological and growth parameters can be effectively used for identification and grouping of agents which can be further used. Among the treatments studied, treatments T_6 (*Paceilomyces lilacinus*), T_4 (*Pseudomonas fluorescnce*) and T_5 *Bacillus subtilis* were found superior and significant than other treatments for yield and other yield attributing characters. Bio-control agents are providing valuable inputs for development of smart crop improvement technologies. So there is a need of further research work on different bio-control agents to assess their potential for developing pollution free smart green technologies in agriculture.

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