The Pharma Innovation Journal 2023; 12(2): 482-485

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 482-485

www.thepharmajournal.com
Received: 08-12-2022
Accepted: 13-01-2023

Vishal D Adsul
M.Sc. Department of Agril. Botany, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Maharashtra, India

Ramchandra J Navatre
Ph.D. Scholar, Department of Agril. Botany, Post Graduate Institute, MPKV, Rahuri. Maharashtra, India

Shital S Jamdade
M.Sc. Scholar, Department of Agronomy, Post Graduate Institute, MPKV, Rahuri. Maharashtra, India

Kiran D Varnekar
Ph.D. Scholar, Department of Agronomy, Post Graduate Institute, MPKV, Rahuri. Maharashtra, India

Corresponding Author:
Vishal D Adsul
M.Sc. Department of Agril. Botany, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Maharashtra, India

Effect of bio control agent on growth parameter and physiological aspects of wal (*Lablab purpureus* L.)

Vishal D Adsul, Ramchandra J Navatre, Shital S Jamdade and Kiran D Varnekar

Abstract
The present experiment was conducted at education and research farm, Dept. of Agril. Botany, College of Agriculture, Dapoli during *rabi* 2017-2018 to study the effect of biocontrol agents on physiochemical aspects of Wal (*Lablab purpureus* L). The experiment laid out in randomized block design with variety of wal kokan wal-2 and seven treatments randomized in three replications. The applied seven treatment *viz.* T_0-RDF only, T_1-Rhizobium treatment, T_2-RDF+T_1, T_3-*Tricoderma viride* (4 ml/lit)+T_1, T_4-*Pseudomonas fluorescence* (4 ml/lit)+T_1, T_5-*Bacillus subtilis* (4 ml/lit)+T_1, T_6-*Paceilomyces lilacinus* (4 ml/lit)+T_1 respectively. Different bio control agents were applied through foliar spray at 2st and 4th week after sowing. Data were collected on photosynthesis rate, stomatal conductance, transpiration rate and growth parameter like AGR, RGR, NAR, LAI and leaf area 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.

Keywords: Physiological, AGR, RGR, NAR, LAI, biocontrol agent

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) [5]. 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) [3]. 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) [2]. 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) [1]. 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.

Material 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.

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* (4 ml/lit)+*Rhizobium* treatment only (T_1)
T_4	*Pseudomonas fluorescnce* (4ml/lit)+*Rhizobium* treatment only (T_1)
T_5	*Bacillus subtilis* (4 ml/lit)+*Rhizobium* treatment only (T_1)
T_6	*Pacilomycese lilacinus* (4 ml/lit)+*Rhizobium* treatment only (T_1)

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 physiological characters *viz*. photosynthesis rate, stomatal conductance, transpiration rate and growth parameter *viz.* AGR, RGR, NAR, LAI and leaf area were studied. Critical differences were calculated at five per cent level of significance. Based on the results, high yielding treatments were identified.

Results and Discussion

Physiological parameters

On this pretext improvement in yield level through smart culture management and judicious use of resources occupy a significant position. Rate of photosynthesis is major factor that affects crop growth. The three factors viz. light intensity, carbon dioxide concentration and temperature can limit the speed of photosynthesis. Without enough light plant cannot photosynthesize very quickly, even if there plenty of water and carbon dioxide is available. Increasing the light intensity boosts the speed of photosynthesis. The size of photosynthetic apparatus depends upon the number of leaves of the plant. In present study, periodical monitoring of photosynthesis rate indicated that rate of photosynthesis was higher during 60 DAS and it decreased almost half as the crop mature. All treatment shows variation in net photosynthesis rate. At harvest, the range of photosynthetic rate was 9.600 µmol m-2 s-1 to 13.900 µmol m-2 s-1 (Table No. 2). Treatment T_6 (*Pacilomycese lilacinus)* (13.900 µmol m-2 s-1) showed highest photosynthesis rate among all the treatment followed by T_5 (*Bacillus subtilis)* T_4 (*Pseudomonas fluorescence)* and T_3 (*Tricoderma harzianum).* If transpiration rate is less then it is significant for increasing the crop production. It was recorded that transpiration rate was increased continuously up to 90 days due to temperature is raised and then declined slightly. At harvest transpiration rate ranged between 6.558 to 4.954 µmol m^{-2} s^{-1} (Table No. 4). Hence, treatments T_6 *Pacilomycese lilacinus* (4.954 µmol m^{-2} s^{-1}) T_5 *Bacillus subtili* (5.193 µmol m^{-2} s^{-1}) T_4 *Pseudomonas fluorescence* (5.346 µmol m^{-2} s^{-1}) and T_3 *Tricoderma harzianum* (5.901 µmol m^{-2} s^{-1}) were significant for transpiration rate. Stomatal conductance did not show variation during later the growth stages of the plant except at initial stages (Table No. 3). Hence, treatments T_6 (*Pacilomycese lilacinus)* T_5 (*Bacillus subtilis)* T_4 (*Pseudomonas fluorescence)* and T_3 (*Tricoderma harzianum)* were significant for stomatal conductance. These results are in close association with the result obtained by Saber *et al.* (2009) [6] in *Vicia faba.*

Growth Parameter

The assessment of yield variation in terms of growth and development is very complex, since it involves the effect of external factors on all the physiological processes in plants. It is well established that the infrastructure of the plant is decided by the by the growth parameters such as absolute growth rate (AGR), relative growth rate (RGR), net assimilation rate (NAR), and leaf area index (LAI). Beside the number of leaves, leaf area is also an important factor in determining the size of photosynthetic system. More the leaf area more the scope for absorption of solar radiation.

In the present investigation it was recorded that the leaf area increased periodically in advancing stage of crop. With increase in leaves there was increase in leaf area. At harvest stage decreased leaf area observed mainly due to leaf senescence. Leaf area was recorded maximum when biocontrol agents, *Pacilomycese lilacinus* (785.37cm^2) (Table No. 5) applied followed by treatment *Bacillus subtilis* (711.93 cm^2) *Pseudomonas fluorescence* (686.25cm^2) and *Tricoderma harzianum* (634.77cm^2). Similar results were reported by Kleifeld. O and Chet. I (1992) [4].

In present study, it was observed that LAI increased with advancing age of the crop which is due to increase in number of leaves and decreased at maturity due to the leaf fall. LAI at 90 days after sowing ranged from 1.470 to 1.037 (Table No. 6) which showed that there is wide range of variation among treatments. Similar results were obtained by Kleifeld *et al.* (1992) [4] with *tricoderma* biocontrol agent in plant response.

The absolute growth rate is a daily increment in dry matter over a given period of time. It gives an idea regarding the pattern of growth at different growth stages. In present investigation, it indicates that AGR was higher during 30 and 60 days after sowing and declined thereafter. Increase in AGR was due to increase in total dry weight during this period, as the AGR mainly depends on the accumulation of dry matter. The result of this experiment, treatment *Pacilomycese lilacinus 0.0593* showed maximum AGR respectively followed by treatments. *Bacillus subtilis 0.0585 Pseudomonas fluorescence* 0.0437 *Tricoderma harzianumm* 0.0446 (Table No. 7).

The relative growth rate is an overall measure of rate of increase in dry weight per unit in dry weight. In present investigation it was observed that RGR was maximum during 30 to 60 days period, and then it was reduced up to 90 DAS. This may be due to dry matter accumulation during maturity period was rapid than that during seed feeling stage. In general treatments differed significantly at every stage of growth for relative growth rate. At maturity stage in RGR treatment T_0 (0.0019) showed maximum RGR followed by treatments T_1 (0.0017) (Table No. 8).

Net assimilation rate is rate of increase in dry weight per unit leaf area assuming that both dry weight and leaf area increased exponentially. In present study it was observed that net assimilation rate was maximum during 30 and 60 days after sowing and then it was decreased. This may be due to decrease in dry weight and leaf area at maturity. At maturity stage treatments ranged between 0.000026 g dm^{-2} day^{-1} and 0.000015 g dm^{-2} day^{-1}. This clearly indicated that treatments varied among themselves in the net assimilation rate. In NAR treatment T_1 (0.000026) recorded maximum NAR followed by T_0 (0.000021).and T_6 (0.000021) (Table No. 9).

Table 2: Performance of treatment of bio-control agent on lablab bean for photosynthesis rate.

Mean Photosynthesis rate (µmol CO_2 m^{-2} s^{-1})				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	13.943	18.043	14.957	9.600
T_1	14.143	18.877	15.317	9.957
T_2	15.307	15.770	14.633	9.950
T_3	14.943	19.410	16.477	10.710
T_4	16.833	19.077	16.187	11.767
T_5	16.923	21.257	17.753	12.600
T_6	18.643	21.733	18.987	13.900
S.Em±	1.337	1.087	1.070	1.256
CD at 5%	4.121	3.350	3.297	3.869

Table 3: Performance of treatment of bio-control agent on lablab bean for stomatal conductance.

Mean stomatal conductance (µmol CO_2 m^{-2} s^{-1})				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	0.197	0.211	0.208	0.190
T_1	0.210	0.221	0.204	0.200
T_2	0.202	0.204	0.200	0.238
T_3	0.242	0.265	0.233	0.236
T_4	0.249	0.271	0.239	0.243
T_5	0.252	0.274	0.244	0.240
T_6	0.277	0.299	0.280	0.310
S.Em±	0.018	0.025	0.021	0.027
CD at 5%	0.055	0.076	0.065	0.082

Table 4: Performance of different treatment of bio-control agent on lablab bean for transpiration rate.

Mean Transpiration rate (µmol H_2O m^{-2} s^{-1})				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	3.163	6.972	8.023	6.558
T_1	3.190	6.076	7.448	6.270
T_2	3.050	5.822	7.413	6.098
T_3	2.947	5.366	7.263	5.901
T_4	2.467	5.392	7.051	5.346
T_5	2.333	5.375	6.633	5.193
T_6	2.400	4.939	6.755	4.954
S.Em±	0.224	0.492	0.237	0.386
CD at 5%	0.690	1.516	0.730	1.190

Table 5: Performance of different treatment of bio-control agent on lablab bean for leaf area.

Mean leaf area (cm^2 $plant^{-1}$)				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	189.26	595.60	908.33	607.47
T_1	209.26	689.54	956.72	627.04
T_2	217.12	635.69	1153.34	614.83
T_3	238.80	710.28	1003.18	634.77
T_4	249.14	747.18	1163.82	686.25
T_5	255.00	765.62	1215.17	711.93
T_6	274.04	805.81	1277.63	785.47
S.Em±	16.11	47.41	102.18	49.53
CD at 5%	49.64	146.09	316.24	152.60

Table 6: Performance of different treatment of bio control agent on lablab bean for leaf area index.

Mean leaf area index (LAI)				
Treatments	**30 DAS**	**60 DAS**	**90 DAS**	**At harvest**
T_0	0.210	0.650	1.037	0.708
T_1	0.231	0.696	1.064	0.717
T_2	0.236	0.706	1.101	0.770
T_3	0.261	0.789	1.141	0.812
T_4	0.258	0.830	1.163	0.833
T_5	0.278	0.851	1.250	0.858
T_6	0.330	0.895	1.470	0.873
S.Em±	0.031	0.061	0.111	0.033
CD at 5%	0.095	0.189	0.343	0.104

Table 7: Performance of different treatment of bio control agent on lablab bean for absolute growth rate.

Mean absolute growth rate (AGR) (g day^{-1})			
Treatments	**30-60 DAS**	**60-90 DAS**	**90-At Harvest**
T_0	0.2011	0.0413	0.0293
T_1	0.2082	0.0468	0.0398
T_2	0.2047	0.0752	0.0436
T_3	0.2234	0.1012	0.0446
T_4	0.2399	0.0942	0.0437
T_5	0.2480	0.0851	0.0585
T_6	0.2592	0.1096	0.0593
S.Em±	0.0094	0.0139	0.0083
CD at 5%	0.0291	0.0428	0.0255

Table 8: Performance of different treatment of bio control agent on lablab bean for relative growth rate.

Mean relative growth rate (g g^{-1} day^{-1})			
Treatments	**30-60 DAS**	**60-90 DAS**	**90-At Harvest**
T_0	0.0260	0.0023	0.0019
T_1	0.0267	0.0030	0.0017
T_2	0.0256	0.0032	0.0016
T_3	0.0276	0.0039	0.0015
T_4	0.0315	0.0043	0.0014
T_5	0.0291	0.0042	0.0015
T_6	0.0337	0.0045	0.0015
S.Em±	0.0020	0.0004	0.0005
CD at 5%	0.0062	0.0012	0.0017

Table 9: Performance of different treatment of bio control agent on lablab bean for net assimilation rate.

Mean net assimilation rate (g dm^{-2} day^{-1})			
Treatments	**30-60 DAS**	**60-90 DAS**	**90-At Harvest**
T_0	0.000216	0.000021	0.000021
T_1	0.000230	0.000024	0.000026
T_2	0.000226	0.000038	0.000019
T_3	0.000232	0.000040	0.000019
T_4	0.000233	0.000044	0.000015
T_5	0.000238	0.000040	0.000020
T_6	0.000246	0.000053	0.000021
S.Em±	0.000010	0.000007	0.000008
CD at 5%	0.000030	0.000021	0.000023

Conclusion

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 physiological and Growth parameter. 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.

References

1. Anonymous; c2014. http://www.indiastat.com.
2. Anonymous; c2015. http://www.indiastat.com.
3. FAOSTAT; c2015. http://faostat.fao.org/site.
4. Kleifeld O, Chet I. *Trichoderma harzianum*-interaction with plants and effect on growth response Plant and Soil. 1992;144:267-272.
5. Mureithi JG, Gachene CKK, Ojiem J. The role of green manure legumes in smallholder farming systems in Kenya. Trop. and Subtrop. Agroecosystems 2003;1:57-70.
6. Saber WIA, Abd El-hai KM, Ghoneem. Synergetic effect of trichoderma and rhziobium on both biocontrol of chocolate spot disease and induction of nodulation, physiological activities and productivity of *Vicia faba.* Research journal of microbiology. 2009;4(8):286-300.