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Original Research Article

Physio-biochemical Characterization in Wal

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A B S T R A C T

The field experiment was carried out to study the physiological basis of yield in eighteen different wal (*Lablab purpureus* L.) genotypes at education and research farm, Dept. of Agril. Botany, College of Agriculture, Dapoli during *rabi* 2017-18. The experiment laid out in Randomized Block Design with three replications. Rate of photosynthesis varied from 12.97 to 54.31 µmol CO_2 m^{-2} s^{-1} at 60 days after sowing. The range of stomatal conductance recorded during 30 days period is 0.44 to 1.07 µmol m^{-2} s^{-1}. Transpiration rate ranged from 10.43 to 15.18 µmol H_2O m^{-2} s^{-1}. The range of chlorophyll content recorded during 60 days period is 2.337 mg/g to 2.997 mg/g. Physiological characterization should provide a standardized record of readily assessable plant characters, which go a long way to identify an accession. Because characterization and evaluation will provide a rapid, reliable and efficient means of information for proper utilization of germplasm. This is also helpful to select suitable parental line for further improvement programme.

Keywords

Physio-biochemical, Wal

Introduction

Lablab bean (*Lablab purpureus* L.) an important pulse crop also known as Hyacinth bean, Bonavist (sem), Chicharas, Chink, Pavta, Kadva, Auri, Field bean, Sem, Indian bean, Country bean, is grown throughout the country. It is popularly known as 'Wal' in Maharashtra state. Lablab bean (2n=2x=22) belongs to the family Fabaceae and is also known as Hyacinth bean and Egyptian kidney bean (Verdcourt, 1979) and placed hyacinth bean in a separate genus lablab from Dolichos and designated it as *Lablab purpureus* (L.)

It is a native to India or South-East Asia. It is probably of an Asian origin and has been under cultivation since ancient times. It is adoptable to wide range of climatic conditions (Kimani *et al.*, 2012), such as arid, semi-arid, sub-tropical and humid region where temperature vary between 22^0c to 35^0c, pH range varying from 4.4 to 7.8. Being a legume, it can fix atmospheric nitrogen. It is also nutritionally important. The green pods contain about 3.8 per cent protein with moisture 86.1 per cent, carbohydrates 6.7 per cent and fat 0.7 per cent. It also contains 1.8 per cent fibre and 0.9 per cent ash. The approximate composition of the dry pulse is 24.9 per cent protein with 9.6 per cent moisture, 60.1 per cent carbohydrate, 0.8 per cent fat, 1.4 per cent fibres and 3.2 per cent ash content (Kay, 1975).

Total production of pulses in world is 70 million tonnes from an area of 70 million hectare, with average productivity of 908 kg/ha. India is the major pulse growing country in the world sharing about 25% of total production and 32% of global acreage in the world. In India, area under pulses is 125.60 lakh/ha (Anonymous, 2016). Maharashtra ranks first in acreage and production of pulses followed by Madhya pradesh, Uttar pradesh, Rajasthan, Orissa, Haryana, Gujrat, Karnataka, Tamilnadu and Andhra Pradesh. In India pulses are grown on an area of 24.31 million ha and production of 19.27 million tonnes of grains with average yield of 631.9 kg/ha. In Maharashtra, the total pulse production were 34.46 lakh tonnes, which was produced from 38.26 lakh ha with an average production of 900 kg/ha in year 2013-14. Maharashtra contributes 12 per cent of total production of pulses in India (FAO, 2012). while in Konkan region total pulse area is 27.2 thousand ha with production of 16.70 thousand tonnes (Anonymous, 2016).

It yields 5 to 10 t/ha of green matter, which can be used as fodder or green manure. It improves the soil condition and is relatively drought tolerant; it is also a good cover crop. As forage, it is very palatable, either as green fodder or as silage. It is an excellent nitrogen fixer and is sometimes grown as a cover crop or for livestock fodder. It is primarily grown for fresh seeds and used as a vegetable. Therefore, fresh pods containing immature seeds are marketable economic products in dolichos bean (Vishwanath *et al.,* 1971, Shivashankar and Kulkarni 1989).

Materials and Methods

The present investigation was carried out at Education and Research Farm, Department of Agricultural Botany, College of Agriculture, Dapoli, during the year 2017-18. In this study, 18 kadwa wal genotypes (Table 1) having different growth and yield characters used for physiological characterization.

The experiment was laid out in randomized block design with three replications, provided with eighteen treatments (eighteen different genotypes of wal). Application of FYM @10 tons/ha was incorporated at the time of preparation of land. Fertilizers were applied @ 25 kg N_2O, 50 kg P_2O_5 per hectare at the time of sowing. Rate of photosynthesis, rate of transpiration and stomatal conductance was measured by using Infra-Red Gas Analyser (IRGA) machine and total chlorophyll content of the leaves was calculated by using the formula given by Arnon (1949).

Results and Discussion

Rate of photosynthesis is major factor that affects crop growth. It determines amount of food generated per sq. meter per second. In present study of genotypes, rate of photosynthesis varied significantly while periodical monitoring of photosynthesis rate indicated that rate of photosynthesis was higher during 60 days after sowing and it decreased later. At morning between 9 to 11 am photosynthesis rate showed optimum value while at noon, due to closing of stomata and high light intensity the rate was decreased. At 60 DAS, rate of photosynthesis varied in the range of 54.31 - 39.34 µmol CO_2 m^{-2} s^{-1}. Maximum and minimum rate was recorded in treatments T_6 and T_{16} respectively. These results are in close association with findings of Kripa Ram (2013) in mustard (*B. juncea* (L.) Czern & Coss) (Table 2–5).

Very small amount of variation was observed between stomatal conductance. Maximum stomatal conductance was observed in T_5 and T_{14} while minimum of it was observed in T_{15}. At harvest, stomatal conductance varied in between 0.337 µmol m^{-2} s^{-1} and 0.174 µmol m^{-2} s^{-1}. Similar results reported by Zinlala (2014).

The rate of transpiration is also influenced by the evaporative demand of the atmosphere surrounding the leaf such as humidity, temperature, wind and incident sunlight (Sinha and Kumar, 2004).

It was observed that transpiration rate was higher in 30 days due to rise in temperature and then it declined slightly. It increased with advancing age of the crop due to increase in temperature. Genotypes ranged between (T_7) 15.18 and (T_{15})10.43 µmol m^{-2} s^{-1}. At 60 days after sowing, maximum and minimum rate of transpiration was found in T_{11} and T_{17} respectively. Similar findings were reported by Zinlala (2014).

Life is a photochemical phenomenon. The chemical compounds most important in this conversion of light energy to chemical energy are the pigments that exist within the chloroplast or chromatophores of the plant. Chlorophyll is the principal organelle which carries out process of photosynthesis. Ultimately food is generated in this apparatus. Thus it is important to know the amount of chlorophyll present in the leaf tissue to determine photosynthetic efficiency of the plant. The present investigation showed that chlorophyll content increased with advancing age of the crop and it was reduced during maturity phase.

Total chlorophyll content increased with advancing age of the crop and it was maximum during 60 days of crop growth and it started declining thereafter. Maximum chlorophyll content was recorded in T_9 followed by T_{16} and minimum of it was observed in T_1. The range of chlorophyll content recorded during 60 days period is 2.997 mg/g to 2.337 mg/g. Similar results reported by Sankar Ganesh (2015) estimated chlorophyll content in cowpea at different zinc concentrations. Also, Francis (2006) found similar results in cowpea and he stated that spectrophotometer could be used as yield prediction tool in screening and selection of cowpea genotypes.

It is concluded that, the physio-biochemical characters can be effectively used for identification and grouping of varieties which can be further used for breeding programme.

Table.1 Number of Treatments: 18 (Genotypes)

Treatments	Cultures	Treatments	Cultures
T1	DPLW-2010-4-1-1-15	T10	DPLW-2010-12-1-2-10
T2	DPLW-2010-4-4-1-17	T11	DPLW-2010-13-5-3-1
T3	DPLW-2010-5-4-2-20	T12	DPLW-2010-17-4-1-10
T4	DPLW-2010-6-1-1-8	T13	DPLW-2010-18-1-1-5
T5	DPLW-2010-6-2-2-7	T14	DPLW-2010-18-3-1-2
T6	DPLW-2010-6-5-3-20	T15	DPLW-2010-18-3-2-9
T7	DPLW-2010-7-4-1-31	T16	DPLW-2010-18-5-1-8
T8	DPLW-2010-8-2-2-26	T17	DPLW-2010-19-3-1-3
T9	DPLW-2010-9-4-1-20	T18	KONKAN WAL 2

Table.2 Mean performance of different lablab bean genotypes for photosynthesis rate (µmol CO_2 m^{-2} s^{-1})

Mean photosynthesis rate (µmol CO_2 m^{-2} s^{-1})			
Treatments	**30 Das**	**60 DAS**	**90 DAS**
T_1	36.88	40.53	31.37
T_2	39.67	50.23	39.12
T_3	36.63	45.27	35.76
T_4	34.96	44.61	28.33
T_5	41.11	42.72	27.99
T_6	39.96	54.31	24.79
T_7	41.84	44.25	32.35
T_8	38.98	44.73	34.01
T_9	39.51	39.71	26.08
T10	33.74	44.82	37.21
T11	32.86	42.71	37.95
T12	36.79	41.78	35.39
T13	34.36	46.54	31.32
T14	34.66	39.98	31.11
T15	35.06	41.99	32.72
T16	36.64	39.34	30.30
T17	31.81	48.61	25.79
T18	33.59	50.46	40.45
S.Em ±	**3.42**	**2.97**	**3.50**
CD @ 5%	**9.82**	**8.54**	**10.05**

Table.3 Mean performance of different lablab bean genotypes for stomatal conductance (µmol m^{-2} s^{-1})

Treatments	30 DAS	60 DAS	90 DAS
T_1	1.07	0.35	0.34
T_2	0.75	0.45	0.48
T_3	0.58	0.32	0.41
T_4	0.69	0.38	0.40
T_5	0.74	0.26	0.32
T_6	0.66	0.29	0.30
T_7	0.79	0.41	0.47
T_8	0.88	0.44	0.40
T_9	0.69	0.32	0.30
T10	0.47	0.30	0.74
T11	0.54	0.26	0.75
T12	0.69	0.30	0.57
T13	0.44	0.33	0.48
T14	0.57	0.26	0.52
T15	0.56	0.34	0.47
T16	0.53	0.33	0.61
T17	0.59	0.31	0.26
T18	0.45	0.41	0.63
S.Em ±	**0.007**	**0.008**	**0.005**
CD @ 5%	**0.023**	**0.023**	**0.016**

Table.4 Mean performance of different lablab bean genotypes for transpiration rate (µmol H_2O m^{-2} s^{-1})

Treatments	30 DAS	60 DAS	90 DAS
T_1	13.32	8.73	6.74
T_2	14.96	10.16	10.28
T_3	11.78	8.76	8.56
T_4	12.47	9.34	8.01
T_5	13.42	7.53	7.57
T_6	14.23	9.04	7.36
T_7	15.18	9.43	9.26
T_8	14.03	9.79	8.63
T_9	13.69	8.46	6.76
T10	11.99	8.61	11.63
T11	12.94	7.37	11.92
T12	15.16	8.92	11.33
T13	10.45	9.39	9.29
T14	11.89	6.52	9.99
T15	10.43	8.65	8.57
T16	11.57	8.39	10.15
T17	12.98	9.07	6.34
T18	11.24	9.66	11.14
S.Em ±	**0.10**	**0.21**	**0.28**
CD @ 5%	**0.30**	**0.61**	**0.80**

Table.5 Mean performance of different lablab bean genotypes for chlorophyll content (mg/g)

Treatments	30 DAS	60 DAS	90 DAS
T_1	0.959	2.337	1.303
T_2	0.741	2.815	0.632
T_3	1.023	2.693	0.749
T_4	1.060	2.775	1.010
T_5	0.904	2.597	0.712
T_6	0.998	2.867	0.725
T_7	1.164	2.754	0.609
T_8	1.165	2.885	0.705
T_9	1.223	2.997	0.632
T10	0.966	2.788	0.658
T11	1.014	2.604	0.567
T12	1.100	2.732	0.763
T13	0.921	2.626	0.506
T14	1.137	2.617	0.665
T15	1.048	2.826	0.632
T16	1.197	2.893	0.524
T17	0.989	2.798	0.882
T18	1.020	2.664	0.689
S.Em ±	**0.08**	**0.10**	**0.10**
CD @ 5%	**0.24**	**0.28**	**0.28**

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