Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 3176-3180

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 Special Issue-7 pp. 3176-3180
Journal homepage: http://www.ijcmas.com

Original Research Article

Evaluation of Lentil (*Lens culunaris* Medrik) Genotypes for Moisture Stress Plant Traits, Yield and Seed Quality under Rainfed Condition

Vaishali Gangwar* and Brajesh Kumar

Department of Crop Physiology, Chandra shekhar Azad University of agriculture & technology, Kanpur-208002, India
**Corresponding author*

A B S T R A C T

Twenty genotypes of lentil (*Lens culunaris* Medrik) were evaluated for moisture stress plant traits, yield and seed quality under rainfed condition in a field trial during *rabi* 2007-08 and 2008-09. Results indicated that genotypes KLB 353, 346, 344, 301, 303, 340 and DPL 62 attained higher values of relative water content (RWC), Leaf water potential (LWP), Nitrate reductase activity (NRA), chlorophyll and proline content in leaves and produced higher biological as well as seed yield per plant. However, seed protein content was estimated higher in genotypes KLB 345, 357, 359 and 341 in order of merit. Thus, protein content in seed was not influenced by moisture stress plant traits of lentil crop.

Keywords

Chlorophyll, Proline, Protein, Leaf water potential, Genotypes, Nitrate reductase activity, Relative water content, Lentil

Introduction

Pulses contribute economic and nutritional importance next to cereals as human food. The ability of pulses to fix atmospheric nitrogen in the soil crop system is their unique and beneficial charecterstic among all plant species. Water requirement of pulse crops is generally low.

They have deep root system, which enables them to extract soil moisture from deeper layers. Because of these charecteristics they are generally grown in rainfed areas. In India pulses occupy an area of 22-23 m hac with total production of 13-14 m tonnes. The abrupt climatic change, particularly the erratic rainfall is one of the major causes of reduced pulse production in India (Ali and Gupta, 2012).

The commonly grown pulses in India are gram or chickpea, arhar or pigeonpea, mungbean or green gram, urdbean or blackgram, masoor or lentil, pea and lathyrus. In India, lentil (*Lens culunaris* Medrik) is recognised as one of the most nutritious and widely adopted pulse crop next to chickpea among rabi pulses. Its cultivation is extended upto altitudes of 3500 meters in north-west India. It is grown during *rabi* season mostly under rainfed condition with receding soil moisture. Lentil grows well on a wide range of soils, ranging from light sand loam to heavy clay soils.

Growing of suitable varieties which are tolerant to soil moisture stress are essential for higher production and profitability. The important physiological processes namely photosynthesis, respiration, transpiration, stomatal resistance, water use efficiency, source-sink relationships and plant nutrition have been linked to drought tolerance mechanism (Boyer,1996; Lodlow and Muchow, 1990).

Physiological and biochemical approaches also have a great importance for understanding the complex machanisms of plants to water deficiency and with the result reserchers may develop new varieties. Water stress conditions mostly affects growth of leaves and roots, photosynthesis and dry mater accumulation (Blum, 1996). Plants growing in drought condition may have ability to avoid drought stress or to tolerate stress.

Drought resistant plants have high photosynthetic rate and they store much quantity of water for proper hydration of protoplasm. Water stress affect virtually every aspect of physiology and metabolism of plant. High water stress increases the protoplasmic viscocity which interferes with the smooth functioning of enzymes and their metabolic activities. Water stress brings about structural and functional changes in the membranes.

Water deficit in plants causes dehydration, due to which plant remain stunted. Some of the plants under water stress bring about osmotic adjustment or osmoregulation by lowering the osmotic potential by accumulating some organic compounds such as proline, sucrose etc. Genotypes, those are drought resistant but low yielder, may be used in varietal improvement programmes by the breeders.

The present investigation on lentil (*Lens culinaris* medic) genotypes under soil moisture stress condition will be under taken to critically examine the extent of morpho-physiological variabilities in different lentil genotypes, particularly to quantify the key traits conferring drought tolerance and identify a number of promising lentil genotypes for their stable performance under soil moisture stress conditions.

Materials and Methods

The field experiment was conducted at Crop Research Farm, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur during *rabi* 2007-08 and 2008-09 under rainfed condition.

Treatments comprised twenty genotypes of lentil which were tested in randomized block design with three replications. Crop was raised with recommended package of practices. The moisture stress parameters recorded at the crop stage of 50% flowering are presented in results.

Those were determined by standard methods

Relative water content – Weatherly and Slatyer (1957).

Leaf water potential – Pressure Bomb Technique (Soil Moisture Equipment Corporation U.S.A.).

Nitrate reductase activity – Klipper (1971).

Chlorophyll content – Arnon (1949).

Proline content – Singh *et al.*, (1972).

Seed yield and biological yield were recorded per plant at maturity stage of plants while seed protein content was estimated after crop harvest in dry seeds. For protein, first N content in seed was determined by micro-Kjeldahl method and than it was multiplied with 6.25 factors.

Table.1 Physiological parameters, yields and seed protein content in lentil genotypes

Genotypes	2007-08								2008-09							
	Relative water content (%)	Leaf water potential (-MPa)	Nitrate reductase activity	Chlorophyll content (mg/g F.W.)	Proline content (µg/g F.W.)	Biological yield (kg/ha)	Seed yield (kg/ha)	Protein % in seed	Relative water content (%)	Leaf water potential (-MPa)	Nitrate reductase activity	Chlorophyll content (mg/g F.W.)	Proline content (µg/g F.W.)	Biological yield (kg/ha)	Seed yield (kg/ha)	Protein % in seed
KLB 301	81.00	-1.22	4.34	5.63	1237	10.43	4.80	24.20	82.68	-1.20	4.37	5.70	1242	10.54	4.91	24.20
KLB 302	73.12	-1.46	3.76	4.81	1165	9.29	4.28	25.10	76.32	-1.40	3.78	4.93	1173	9.43	4.30	25.20
KLB 303	80.00	-1.20	4.58	5.70	1351	11.84	5.43	24.80	81.99	-1.19	4.59	5.98	1355	11.95	5.45	24.90
KLB 340	79.26	-1.26	4.27	5.51	1205	10.51	5.35	24.50	80.00	-1.23	4.28	5.67	1214	10.70	5.40	24.60
KLB 341	74.60	-1.43	3.80	4.58	1181	9.69	5.05	25.30	76.42	-1.41	3.83	4.85	1196	9.71	5.09	25.40
KLB 342	77.80	-1.31	4.18	4.85	1169	9.84	4.43	25.20	81.06	-1.30	4.19	4.96	1178	9.90	4.60	25.00
KLB 343	71.50	-1.51	3.60	4.91	1020	10.30	4.15	24.10	74.00	-1.48	3.90	4.95	1039	10.48	4.30	24.30
KLB 344	81.74	-1.18	4.47	5.75	1301	10.07	6.27	25.40	82.32	-1.16	4.49	5.84	1323	10.17	6.34	25.60
KLB 345	76.09	-1.37	4.22	5.33	1167	9.63	4.63	25.60	77.98	-1.35	4.25	5.40	1175	9.79	4.68	25.80
KLB 346	83.84	-1.14	4.60	5.85	1464	10.97	5.45	24.00	84.49	-1.11	4.63	5.99	1472	11.00	5.51	23.57
KLB 347	68.10	-1.68	3.91	4.22	860	9.66	3.95	23.60	70.72	-1.58	4.00	4.30	900	9.77	4.00	23.70
KLB 348	68.00	-1.63	3.40	4.04	800	9.75	4.07	24.60	69.12	-1.57	3.44	4.20	807	9.84	4.11	24.80
KLB 349	75.06	-1.41	3.85	5.53	1155	10.20	4.50	25.10	78.42	-1.38	3.87	5.47	1168	10.37	4.55	25.30
KLB 350	73.00	-1.49	3.71	5.00	1084	9.14	4.25	24.00	76.58	-1.45	3.73	5.08	1097	9.59	4.30	24.10
KLB 353	82.70	-1.16	4.66	6.19	1519	11.89	6.25	25.00	83.91	-1.06	4.67	6.31	15.32	11.99	6.33	25.10
KLB 354	70.96	-1.60	3.52	4.58	1000	9.71	4.12	24.80	71.05	-1.56	3.62	4.75	10.10	9.96	4.21	24.80
KLB 357	68.08	-1.56	3.66	4.99	1036	8.87	4.20	25.60	70.00	-1.51	3.69	5.08	1058	9.00	4.28	25.70
KLB 359	74.21	-1.66	3.56	4.86	997	9.39	4.00	25.40	75.02	-1.59	3.58	4.86	1011	9.61	4.10	25.50
K 75	76.00	-1.39	3.87	5.30	1295	9.46	5.14	24.60	78.89	-1.35	3.88	5.37	1301	9.62	5.18	24.70
DPL 62	79.10	-1.28	4.30	5.61	1270	10.07	6.05	23.80	80.10	-1.18	4.23	5.45	1283	9.59	6.10	24.00
S.Ed. ±	2.56	0.09	0.19	0.13	101	0.87	0.31	0.08	2.20	0.09	0.26	0.15	96	0.90	0.34	0.12
C.D. (P=0.05)	5.18	0.17	0.38	0.25	203	1.76	0.63	0.17	4.44	0.18	0.52	0.30	194	1.81	0.68	0.25

Results and Discussion

Relative water content and leaf water potential both were recorded maximum in genotype KLB 346 followed by KLB 353 and 344, but genotypes KLB 301, 303, 340 and DPL 62 also remained significantly *at par* with KLB 346 and others in top significant group. Nitrate reductase activity was found highest in genotype KLB 353 and was followed by KLB 346, 303, 344, 301 and DPL 62 according to merit being all significantly at some bar, but KLB 353 proved significantly superior to all remaining genotypes. Total chlorophyll content was estimated significantly maximum in KLB 353. It was followed by genotypes KLB 346, 344, 303, 301 and DPL 62, which remained significantly *at par* with each other. Genotype KLB 353 being *at par* with 346 and 303 recorded significantly higher value of leaf proline content than all other genotypes under test. However, genotypes KLB 344, K 75 and DPL 62 recorded proline content significantly *at par* with KLB 346 and 303. Thus, the genotypes KLB 353, 346, 303, 301 and DPL 62 in general had higher values of moisture stress resistant traits and showed better resistance to soil moisture stress condition as compared to other genotypes tested. These results support the findings of Kumari *et al.,* (2004), Shrestha *et al.,* (2006) and Sabale and Kale (2007).

Biological yield/plant was recorded highest in genotypes KLB 353 which being *at par* with the yields of KLB 303, 346, 340, 301, 343 and 349 was found significantly higher than all other genotypes. Similarly, seed yield/plant of genotypes KLB 344 and 353 being *at par* with the seed yield of DPL 62, was found significantly higher than all other genotypes. These were followed by KLB 346 and 303 in respect to seed yield. Such higher biological and seed yields in above mentioned genotypes might be associated with higher values of RWC, LWP, NRA, chlorophyll and proline contents which might have induced resistance towards soil moisture stress condition under rainfed situation where rains received almost negligible during crop period in both years of experimentation.

Protien content in lentil seeds was affected significantly by genotypes (Table 1). The seeds of genotypes KLB 345 and 357 being *at par* with each other contained significantly higher protein than all other genotypes. These were followed by KLB 344, 359, 341 and 342 genotypes. These results show that protein content in seed was not associated with drought parameters or yields of lentil. It is a genetic character and depends on gene effect. According to Singh *et al.,* (1990), protein content in chickpea seeds varied from 14.3 to 27.0% in different genotypes. Ashraf and Karim (1991) reported that protein content in most of the blackgram cultivars seeds increased under moisture stress condition. It supports the results of present investigation.

References

Ali, M., Gupta, S. 2012. Carrying capacity of Indian agriculture: pulse crops. Current Science 102(6):874-881

Arnon, D.I. 1949. Copper enzymes in isolated chloroplast, polyphenyl oxidase in *Beta vulgaris. Plant Physiology,* 24: 1-5.

Ashraf, M. and Karim, F. 1991. Screening of some cultivars line of blackgram for resistance to water stress. *Tropical Agriculture,* 68 (1): 57-62.

Blum A 1996. Crop response to drought and the interpretation of adaptation. J. Plant Growth Regul. 20(2): 135-148.

Kumari, M., Dass, S., Vimla, Y. and Arora, P. 2004. Physiological parameters governing drought tolerance in maize. *Indian Journal of Plant Physiology,* 9 (2NS): 203-207.

Sabale, A. and Kale, P.B. 2007. Response and recovery of *Coriandrum sativum* L. variety 'Indoori' exposed to soil moisture stress. *Indian Journal of Plant Physiology*, 12 (3): 266-270.

Shrestha, R., Turner, N.C., Siddique, K.H.M. and Turner, D.W. 2006. Physiological and seed yield responses to water deficits among lentil genotypes from diverse origin. *Australian Journal of Agicultural Research*, 57 (8): 903-915.

Singh, K.B., Williams, P.C. and Nakkaul, H. 1990. Influence of growing season, location and plnating time on some quality parameters of *Kabuli* chickpea. *Journal of Science, Food and Agriculture*, 53 (4): 429-441.

Singh, T.N., Aspinall, D. and Paleg, L.G. 1972. Accumulation of proline and varietal adoptability to drought in barley: a potential metabolic measure of drought resistance. *Nature New Biology*, 236: 188-190.

Weatherly, P.E. and Slatyer, R.O. 1957. Relationship between relative turgidity and different pressure deficit in plants. *Nature*, 179: 1085-1086.