International Journal of Agricultural Sciences
Volume **9** | Issue 1| January, 2013 | 326-328

RESEARCH PAPER

Biochemical basis of productivity in little millet (*Panicum miliare* L.)

S.G. GOLLAGI*, M.B. CHETTI AND V.H. ASHVATHAMA
Department of Crop Physiology, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

Abstract : Crop yield is mainly dependent on the interplay of various physiological and biochemical functions of the plants in addition to the impact of environment. A cause and effect relationship is necessary to understand interplay of several processed and functions affecting crop yield. The genotypes TNAU-63, OLM-20 and TNAU-89 recorded higher total chlorophyll and nitrate reductase activity. Correlation study indicated that a significant and a positive association of thses parameters with grain yield. Chlorophyll a, b, total chlorophyll and nitrate reductase activity had positive correlation with yield.

Key Words : Biochemical parameters, Little millet genotypes, Yield

View Point Article : Gollagi, S.G., Chetti, M.B. and Ashvathama, V.H. (2013). Biochemical basis of productivity in little millet (*Panicum miliare* L.) . *Internat. J. agric. Sci.*, **9**(1): 326-328.

Article History : Received : 10.08.2012**; Revised :** 01.12.2012**; Accepted :** 26.12.2012

INTRODUCTION

Little millet (*Panicum miliare* L.), commonly known as Same is an important minor millet belonging to the family Poaceae. It is rich in nutrients. It is suited to conditions of low and moderate rainfall areas ranging from 500 to 700 mm. It is widely cultivated as a cereal across India, Nepal and Western Burma. It is particularly important in the Eastern Ghats of India, where it forms important part of tribal agriculture. In India, the cultivation of little millet is mainly confined to Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Orissa, Bihar, Madhya Pradesh and Uttar Pradesh. It is known that biochemical parameters may affect yield in many ways. It is better to identify those which have close positive relation with grain yield. With this background, the present study was taken up.

MATERIALS AND METHODS

A field experiment on little millet was conducted with 13 genotypes at university of Agricultural Sciences, Dharwad. The genotypes were classified in to high yielding (TNAU-63, OLM -20, TNAU-89, CO-2), medium yielding (OLM-203, TNAU-98, DLM-423, OLM -23) and low yielding (DLM - 322,Varisukhdar,OLM-37PRC-3). Along with local check above little millet genotypes were sown in Randomized Block Design with three replications.

Total chlorophyll, Chl. 'a' and 'b' contents in leaf were determined by following the acetone extraction method of Arnon (1949). The nitrate reductase activity (NRA) *in vivo* was assayed in leaves by the method of Saradhambal *et al*. (1978). The mean values for the characters subjected to statistical analysis were suggested by Panse and Sukhatme (1967). Correlation analysis was carried out to study nature and degree of relationship between biophysical parameters with yield by following the method of Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Crop yield is mainly dependent on the interplay of various physiological and biochemical functions of the plants in addition to the impact of the environment. The cause and effect relationship is necessary to understand the interplay of

*** Author for correspondence and Present Address :** Department of Crop Physiology, University of Horticultural Sciences, BAGALKOT (KARNATAKA) INDIA

Table 1: Genotypic differences in little millet for chlorophyll 'a' and chlorophyll 'b' contents at different stages

Genotype	Chlorophyll 'a' (mg g fr. wt.$^{-1}$)		Chlorophyll 'b' (mg g fr. wt.$^{-1}$)	
	60 DAS	80 DAS	60 DAS	80 DAS
High yielding				
TNAU	1.840	0.821	0.915	0.730
OLM	1.650	0.827	0.881	0.716
TNAU	1.880	0.970	1.201	0.600
CO	1.900	0.710	1.153	0.551
Mean	1.820	0.832	1.037	0.649
Medium yielding				
OLM-203	1.620	0.811	1.001	0.610
TNAU-98	1.560	0.790	0.899	0.620
DLM-423	1.880	0.890	0.980	0.615
OLM-23	1.510	0.690	0.997	0.650
Mean	1.642	0.795	0.969	0.623
Low yielding				
DLM-322	1.400	0.791	0.910	0.601
Varisukhadar	1.350	0.800	0.880	0.570
OLM-37	1.328	0.812	0.811	0.490
PRC-3	1.280	0.711	0.786	0.533
Mean	1.340	0.778	0.846	0.548
Check				
Local	1.512	0.612	0.980	0.701
S.Em±	0.09	0.024	0.018	0.042
C.D. (5%)	0.27	0.071	0.052	0.120

Table 2: Genotypic differences in little millet for total chlorophyll content and nitrate reductase activity at different stages

Genotype	Total Chlorophyll (mg g fr. wt.$^{-1}$)		Nitrate reductase activity (μ mol NO_2 g fr. wt.$^{-1}$ h^{-1})	
	60 DAS	80 DAS	60 DAS	80 DAS
High yielding				
TNAU-63	2.76	1.55	0.844	0.716
OLM-20	2.53	1.54	0.640	0.601
TNAU-89	3.08	1.57	0.830	0.730
CO-2	3.05	1.26	0.707	0.608
Mean	2.85	1.48	0.755	0.664
Medium yielding				
OLM-203	2.62	1.42	0.601	0.513
TNAU-98	2.35	1.41	0.709	0.505
DLM-423	2.86	1.50	0.603	0.515
OLM-23	2.50	1.34	0.506	0.499
Mean	2.58	1.41	0.604	0.508
Low yielding				
DLM-322	2.31	1.39	0.401	0.380
Varisukhadar	2.23	1.37	0.471	0.407
OLM-37	2.14	1.30	0.580	0.506
PRC-3	2.07	.24	0.525	0.499
Mean	2.18	1.32	0.494	0.448
Check				
Local	2.49	1.31	0.512	0.468
S.E.±	0.19	0.11	0.083	0.06
C.D. (5%)	0.56	0.32	0.240	0.20

Table 3: Correlation co-efficient values for grain yield v/s. different biochemical parameters

Sr. No.	Parameters	Correlation values (r)
1.	Total chlorophyll (60 DAS)	0.72**
2.	Total chlorophyll (80 DAS)	0.68**
3.	Nitrate reductase activities (60 DAS)	0.81**
4.	Nitrate reductase activities (80 DAS)	0.84**

* and ** Indicate significance of values at P=0.05 and 0.01, respectively

several processes and functions affecting crop yield.

Higher photosynthetic rate is one of the factors for realising higher grain yield because, it is expected to provide the raw material and the energy required for growth and development. Murthy *et al*. (1976) reported that variations in photosynthesis are associated with leaf protein content, nitrogen, leaf thickness and chlorophyll content per unit area. However, chlorophyll has not always been shown to have strong relationship with photosynthetic rate under normal conditions. But at lower light intensity, it becomes a deciding factor (Janardhan, 1977).

Results of the present study indicated that the chlorophyll 'a', chlorophyll 'b' and total chlorophyll contents in leaf were higher at 60 DAS and decreased at 80 DAS (Table 1). The high yielding genotypes TNAU-89 and CO-2 had higher total chlorophyll content (>3.0 mg g fr. wt.$^{-1}$) (Table 2). A wide genotypic variation for chlorophyll 'a', chlorophyll 'b', total chlorophyll and their decreasing trend towards maturity were reported in foxtail millet (Udapudi, 1996 and Bhoite, 2000), pearl millet (Phul *et al*., 1974) and wheat (Sirohi and Ghildiyal, 1975).

Correlation studies also revealed that chlorophyll 'a', chlorophyll 'b' and total chlorophyll contents had a significant positive association with grain yield and NRA (Table 3). Hence, it is reasonable to attribute that chlorophyll plays a major role in controlling grain growth rate and grain filling processes. Positive correlation of chlorophyll content with photosynthetic rate was also reported in rice (Liu *et al.*, 1992).

The enzyme nitrate reductase catalyses the reduction of nitrate to nitrite, which is the first step in the assimilation of nitrate by the plants (Kumar *et al*., 1989). It has been reported by Bowerman and Goodman (1971) that dry matter accumulation is significantly and positively associated with corresponding nitrate reductase activity in lolium. However, in the present investigation, the NRA was found to have significant positive correlation with grain yield and chlorophyll content. Further, the NRA was significantly higher in high yielding genotypes, TNAU-89, TNAU-63 and CO-2 at all the stages over other genotypes. It indicates that NRA was one of the important biochemical parameters which need to be considered in categorizing the genotypes and yield determination in little millet (Table 2). Correlation studies also indicated positive significant association of chlorophyll content and nitrate reductase activity with grain yield (Table 3).

REFERENCES

Arnon, D. I. (1949). Copper enzymes in isolated chloroplasts: Poly phenol oxidase in *Beta vulgaris* (L.). *Plant Physiol.*, **24**:1-15.

Bhoite, A.G. (2000). Physiological indices for higher productivity in foxtail millet. Ph.D. Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Bowerman, A. and Goodman, P.J. (1971). Variation in nitrate reductase activity in Lolium. *Ann.Bot.*, **35** : 353-366.

Janardhan, K. V. (1977). Studies on carbon assimilation in rice (*Oryza sativa* L.), Ph.D. Thesis, Utkal University Bhubaneshwar, ORISSA (INDIA).

Kumar, P.A., Nair, T.V.R. and Abrol, Y.P. (1989). Nitrate reductase : localization and source of reductant. *Proc. Indian Nat. Sci. Acad.*, **54** : 409-412.

Liu, T.G., Jiang, L.Q. and Yu, Y.B. (1992). Comparative studies on the photosynthesis characters in foxtail millet of different ecotypes. *Scientia Agricultura Sinica*, **25**(3) : 37-43.

Panse, V.G. and Sukhatme, P.V. (1967). Statistical mathods for agricultural workes. I.C.A.R. Publication, NEW DELHI, INDIA.

Phul, P.S., Gupta, S.K.and Gill, K.S. (1974). Association analysis of some morphological and physiological traits in pearl millet. *Indian J. Genet.*, **34**(3) : 346-351.

Sirohi, G.S. and Ghildiyal, M.C. (1975). Varietal differences in photosynthetic carboxylases and chlorophyll in wheat varieties. *Indian J.Exp. Biol.*, **13**(1) : 42-44.

Udapudi, S.S. (1996). Physiological basis of productivity in foxtail millet (*Setaria italica* L.) genotypes. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

*_*_*_*_*_*