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INFLUENCE OF DATE OF SOWING, ROW SPACING AND FERTILIZER LEVELS ON YIELD AND ECONOMICS ON BROWN TOP MILLET (*BRACHIARIA RAMOSA* L.)

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ABSTRACT

A field experiment was conducted at the College of Agriculture farm, Raichur on medium black soil during *kharif*, 2022-23 to study the effect of date of sowing, row spacing and fertilizer levels on yield and economics of Brown top millet (*Brachiaria ramosa* L.)The results revealed that, early sowing during first fortnight of July recorded higher ear head weight (4.48 g), ear head length (16.60 cm), test weight (3.48 g), grain yield (1868 kg ha^{-1}), straw yield (3905 kg ha^{-1}), gross returns (` 76508 $ha^{-1}$), net returns (` 45778 ha^{-1}) and B:C (2.49). However, sowing during second fortnight of July was found to be on par with first fortnight of July. Among fertilizer levels and row spacing, application of 125% RDF with 45 cm row spacing recorded significantly higher ear head weight (4.16 g), ear head length (17.01 cm) and test weight (3.21 g). Whereas, treatment receiving 125% RDF with 30 cm row spacing recorded significantly higher grain yield (1718 kg ha^{-1}), straw yield (3904 kg ha^{-1}), gross returns (` 70492 $ha^{-1}$), net returns (` 38914 ha^{-1}) and B:C (2.24).

Key words: Dates of sowing, Economics, Fertilizer levels, Brown top millet, Row spacing, Yield, Yield attributes.

Introduction

In recent years, there has been a growing understanding of the value of millets as an alternative for major cereal crops due to their climatic resistance, as well as their health advantages and nutritional profile. Millets have the ability to help enhance food production in both developing and developed countries. Brown top millet is an annual warm-season species that originated in Southeast Asia (Clayton, 2006). Brown top millet farming is primarily limited to isolated areas of Andhra Pradesh, Karnataka and Tamil Nadu in South India (Kimata *et al*., 2000). It is a short-duration resilient crop that requires little water for growth and development. It quickly covers the land due to its prolific growth and can thus be cultivated as a cover crop on light soils or on hill slopes to reduce soil erosion. It is mostly produced as a fodder crop in the arid regions of Southern India (Sheahan *et al*., 2014). Brown top millet is a highly nutritious grain crop. It is produced as a fast-growing catch crop between commodity crops, is not allelopathic and may collect considerable amounts of zinc and lead in shoot and root tissues, making it a useful plant for soil remediation (Lakshmi *et al*., 2013). It is gluten-free, high in crude fibre (8.2g/100g), iron (7.7mg/100g), zinc (2.75 mg/100g) and antioxidants (Roopa 2015). Brown top millet has recently experienced a surge in popularity among consumers, notably in South India, due to increased awareness of its nutritional benefits. However, output is considerably below actual demand. It reacts well to fertilizers. Inadequate nutrition has an impact on growth and yield, whereas enough nutrition increases the vegetative phase, resulting in a longer crop duration. Thus, determining the optimal fertiliser dose is critical for increasing crop output.

Proper sowing time and nutrient management are major factors that impact crop productivity. The exact timing of planting can boost yields without increasing costs by optimizing the interaction between the plant and its environment. This interaction determines how efficiently physiological processes function and ultimately impacts crop yield. Both sowing dates and fertilizer use must be tailored to local soil fertility, environment and crop variety. Low brown top millet yields are often due to adverse conditions, belated planting, improper cultivation techniques and lacking fertilizer use. Proper management of sowing times and nutrients can increase quality and quantities harvested. The All India Coordinated Research Project on Small Millets recommends a spacing of 22.5 cm×10 cm or 30cm×10cm for all small millet crops. Brown top millet, unlike other tiny millets, requires standardisation of optimal row spacing and fertiliser dosage. As underutilised millet, it has not received much attention in the development of conventional agronomic procedures thus far. Furthermore, appropriate row spacing improves yield. Proper row spacing maximises light interception, penetration and light dispersion in the crop canopy, as well as the average light utilisation efficiency of the leaves in the canopy, all of which impact crop output.

Materials and Methods

The field experiment was conducted during *Kharif,* 2022-23 at Agriculture College farm, Raichur which is situated at 16º 11' 47.6" North latitude and 77º 19' 23.3" East longitude with an altitude of 389 meters above the mean sea level and it falls within the North Eastern Dry Zone (Zone II) of Karnataka to study the influence of brown top millet to dates of sowing, row spacing and fertilizer levels in North Eastern Dry Zone of Karnataka. A field experiment was laid out in split plot design comprised of five main plots (dates of sowing) and four subplots (fertilizer levels with row spacing) which was replicated three times with twenty treatment combinations *i.e.,* dates of sowing (D_1: first fortnight of July, D_2: second fortnight of July, D_3: first fortnight of August, D_4: second fortnight of August, D_5: first fortnight of September) and fertilizer levels with row spacing (F_1S_1: 100% RDF with 30 cm row spacing, F_2S_1: 125% RDF with 30 cm row spacing, F_1S_2: 100% RDF with 45 cm row spacing, F_2S_2: 125% RDF with 45 cm row spacing). Half the dose of nitrogen and entire dose of phosphorous and potassium in the form of urea, diammonium phosphate (DAP) and muriate of potash (MOP) respectively were applied as per the treatments at the time of sowing. Remaining 50% of nitrogen was applied at 30 DAS. Sowing was done on five different dates.

Results and Discussion

Effect of dates of sowing

The grain and straw yields of Brown top millet were considerably impacted by varied planting dates (Table 1). Sowing during the first fortnight of July resulted in considerably higher grain and straw yields (1868 and 3905 kg ha^{-1}, respectively), followed by crop sown during the second fortnight of July (1780 and 3775 kg ha^{-1}, respectively). Late sowing during the first week of September resulted in considerably decreased grain and straw yields (966 and 3157 kg ha^{-1}, respectively). The significantly greater yield in the first fortnight of July is mostly due to an increase in yield attributable features (Table 2) such as ear head length (16.60 cm), ear head weight (4.48 g) and test weight (3.48 g), followed by the second fortnight of July (16.19 cm, 4.39 g and 3.29 g, respectively). The reason could be that the early-sown crop may have benefited from favourable weather conditions, including temperature, sunshine hours, relative humidity, high light interception, low moisture stress and longer and more suitable environmental conditions for vegetative growth. These factors allowed the crop to reach its full potential, which included increased assimilation in the reproductive parts and active photosynthesis. Similar findings were reported by Amanullah *et al.* (2015), Maurya *et al.* (2016), Gavit *et al.* (2017) and Saikishore *et al.* (2020). The data presented in Table 3 revealed that higher gross returns, net returns and B:C ratio were recorded in crop sown during first fortnight of July (` 76508 ha$^{-1}$, ` 45778 ha^{-1} and 2.49, respectively) followed by second fortnight of July (` 72896 ha$^{-1}$, ` 42166 ha^{-1} and 2.37, respectively). Late sowing during first fortnight of September recorded significantly lowest gross returns, net returns and B:C ratio (` 40031 ha$^{-1}$, ` 8461 ha^{-1} and 1.27, respectively). In the end, the economics of crop production determine whether farmers will adopt any new methods. The first two weeks of July saw better grain and straw output than the other sowing dates, which was the main reason for the higher gross returns, net returns and benefit cost ratio. Upadhyay *et al*. (2001), Dapake *et al.* (2016) and Mubeena *et al.* (2019) found similar outcomes.

Effect of fertilizer levels with row spacing

Yield attributes were significantly influenced due to fertilizer levels and row spacing (Table 2). Application of 125% RDF with row spacing of 45 cm recorded higher ear head length (17.01 cm), ear head weight (4.16 g) and test weight (3.21 g) followed by the treatment receiving 100% RDF with 45 cm row spacing (15.55 cm, 3.86 g and 2.89 g, respectively). Lowest values were obtained

Table 1 : Grain yield, straw yield and harvest index of brown top millet as influenced by dates of sowing, row spacing and fertilizer levels.

Treatment	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index
Date of Sowing			
D_1	1868.75	3905.76	0.32
D_2	1780.08	3775.26	0.32
D_3	1424.50	3554.84	0.28
D_4	1215.58	3350.68	0.27
D_5	966.17	3157.76	0.23
S. Em. ±	**33.00**	**52.58**	**0.01**
C. D. at 5 %	**107.62**	**171.48**	**NS**
Fertilizer Levels with row Spacing			
F_1S_1	1526.37	3655.03	0.29
F_2S_1	1718.37	3904.36	0.30
F_1S_2	1181.37	3193.76	0.27
F_2S_2	1377.97	3442.29	0.28
S.E.m±	**38.63**	**30.78**	**0.01**
CD at 5%	**111.57**	**88.91**	**NS**
Interaction D*FS			
$D_1F_1S_1$	1948.83	4023.76	0.33
$D_1F_2S_1$	2162.50	4257.76	0.34
$D_1F_1S_2$	1585.17	3509.09	0.31
$D_1F_2S_2$	1778.50	3832.43	0.31
$D_2F_1S_1$	1901.83	3940.76	0.33
$D_2F_2S_1$	2035.17	4234.76	0.32
$D_2F_1S_2$	1488.50	3342.76	0.31
$D_2F_2S_2$	1694.83	3582.76	0.32
$D_3F_1S_1$	1563.17	3690.76	0.30
$D_3F_2S_1$	1733.50	3920.43	0.31
$D_3F_1S_2$	1071.50	3175.76	0.25
$D_3F_2S_2$	1329.83	3432.43	0.28
$D_4F_1S_1$	1162.83	3362.76	0.26
$D_4F_2S_1$	1503.83	3669.43	0.29
$D_4F_1S_2$	1018.50	3064.43	0.25
$D_4F_2S_2$	1177.17	3306.09	0.26
$D_5F_1S_1$	1055.17	3257.09	0.24
$D_5F_2S_1$	1156.83	3439.43	0.25
$D_5F_1S_2$	743.17	2876.76	0.21
$D_5F_2S_2$	909.50	3057.76	0.23
S. Em. ±	86.38	68.84	0.01
C. D. at 5 %	**NS**	**NS**	**NS**

in treatment receiving 100% RDF with row spacing of 30 cm (10.77 cm, 2.90 g and 2.01 g, respectively). Better growth characteristics such as tillers, leaf area and leaf area index of the crop, effective dry matter partitioning, and enhanced translocation to the sink leading to the formation of more filled and large-sized grains in the ear head, which in turn resulted in higher ear head weight,

Table 2 : Ear head weight, ear head length and test weight of brown top millet as influenced by dates of sowing, row spacing and fertilizer levels.

Treatment	Ear head weight (g plant^{-1})	Ear head length (cm plant^{-1})	Test weight (1000 grains)
Date of sowing (D)			
D_1	4.48	16.60	3.48
D_2	4.39	16.19	3.29
D_3	3.47	13.27	2.57
D_4	2.89	12.59	2.10
D_5	2.41	11.30	1.69
S. Em. ±	**0.04**	**0.17**	**0.11**
C. D. at 5 %	**0.12**	**0.57**	**0.37**
Fertilizer levels (F) with row spacing (S)			
F_1S_1	2.90	10.77	2.01
F_2S_1	3.19	12.61	2.39
F_1S_2	3.86	15.55	2.89
F_2S_2	4.16	17.01	3.21
S. Em. ±	**0.09**	**0.26**	**0.10**
C. D. at 5%	**0.26**	**0.75**	**0.31**
Interaction (D X FS)			
$D_1F_1S_1$	3.77	12.82	2.58
$D_1F_2S_1$	4.17	15.29	3.35
$D_1F_1S_2$	4.80	18.65	3.85
$D_1F_2S_2$	5.17	19.65	4.12
$D_2F_1S_1$	3.70	12.39	2.45
$D_2F_2S_1$	4.00	14.92	2.88
$D_2F_1S_2$	4.74	18.35	3.82
$D_2F_2S_2$	5.10	19.09	4.02
$D_3F_1S_1$	2.84	10.39	1.92
$D_3F_2S_1$	3.17	11.55	2.25
$D_3F_1S_2$	3.84	14.32	2.88
$D_3F_2S_2$	4.04	16.82	3.22
$D_4F_1S_1$	2.34	9.75	1.65
$D_4F_2S_1$	2.54	10.99	1.82
$D_4F_1S_2$	3.24	13.65	2.25
$D_4F_2S_2$	3.44	15.95	2.68
$D_5F_1S_1$	1.87	8.52	1.45
$D_5F_2S_1$	2.07	10.32	1.65
$D_5F_1S_2$	2.67	12.79	1.65
$D_5F_2S_2$	3.04	13.55	2.02
S.Em. ±	0.21	0.59	0.24
C. D. at 5%	**NS**	**NS**	**NS**

ear head length and test weight, may be attributed to improved yield parameters, *i.e.*, ear head weight, ear head length and test weight with greater fertiliser levels. This was in conformity with the findings of Basavarajappa *et al.* (2002), Mubeena *et al.* (2020) and Siddiqui *et al.* (2020). Plants at wider row spacing exploited maximum

Table 3 : Cost of cultivation, gross returns, net returns and BC ratio of brown top millet as influenced by dates of sowing, row spacing and fertilizer levels.

Treatment	Cost of cultivation (` ha^{-1})	Gross returns (` ha^{-1})	Net returns (` ha^{-1})	B:C ratio
Date of sowing (D)				
D_1	30730	76508	45778	2.49
D_2	30730	72896	42166	2.37
D_3	31820	58563	26743	1.84
D_4	31820	50104	18284	1.57
D_5	31570	40031	8461	1.27
S. Em. ±	-	**1317**	**1317**	**0.04**
C. D. at 5%	-	**4294**	**4294**	**0.14**
Fertilizer levels (F) with row spacing (S)				
F_1S_1	31195	62687	31492	2.02
F_2S_1	31578	70492	38914	2.24
F_1S_2	31089	48657	17568	1.57
F_2S_2	31472	56645	25173	1.80
S. Em. ±	-	**1549**	**1549**	**0.05**
C. D. at 5%	-	**4475**	**4475**	**0.14**
Interaction (D X FS)				
$D_1F_1S_1$	30591	79770	49179	2.61
$D_1F_2S_1$	30974	88434	57460	2.86
$D_1F_1S_2$	30485	64967	34481	2.13
$D_1F_2S_2$	30868	72862	41993	2.36
$D_2F_1S_1$	30591	77849	47258	2.54
$D_2F_2S_1$	30974	83329	52355	2.69
$D_2F_1S_2$	30485	61017	30531	2.00
$D_2F_2S_2$	30868	69390	38522	2.25
$D_3F_1S_1$	31681	64177	32496	2.03
$D_3F_2S_1$	32064	71105	39041	2.22
$D_3F_1S_2$	31575	44253	12678	1.40
$D_3F_2S_2$	31958	54715	22757	1.71
$D_4F_1S_1$	31681	48000	16319	1.51
$D_4F_2S_1$	32064	61793	29729	1.93
$D_4F_1S_2$	31575	42077	10502	1.33
$D_4F_2S_2$	31958	48545	16587	1.52
$D_5F_1S_1$	31431	43641	12209	1.39
$D_5F_2S_1$	31814	47798	15984	1.50
$D_5F_1S_2$	31325	30970	-355	0.99
$D_5F_2S_2$	31708	37714	6006	1.19
S. Em. ±	-	**3465**	**3465**	**0.11**
C. D. at 5%	-	**NS**	**NS**	**NS**

natural resources efficiently, besides responding to externally applied inputs and expresses its maximum potential compared to plants at closer spacing where competition would be high. Therefore, wider spacing improves the partitioning of photosynthates to the reproductive parts. Ram *et al.* (2014) and Kumar *et al.* (2019) also reported similarly. The grain and straw yield of Brown top millet was significantly influenced due to the application of RDF and row spacing (Table 1). Application of 125% RDF with 30 cm row spacing recorded significantly higher grain and straw yield (1718 and 3904 kg ha^{-1}, respectively) followed by 100% RDF with 30 cm row spacing (1526 and 3655 kg ha^{-1}). Lowest grain and straw yield were recorded in treatment receiving 100 % RDF with 45 cm row spacing (1181 and 3193 kg ha^{-1}). The high favourable effects of N, P and K such as high chlorophyll synthesis and dehydrogenase activity, also higher source to sink relationship on yield contributing characters could be used as an explanation for the increase in grain production with increased nutrient availability and also high rate of nutrient application improved the growth and yield components by enabling the land to trap higher quantity of radiant energy to convert it into chemical energy. These results support the conclusions of Kaushik and Mahendra (1983), Nigade *et al.* (2006), Chouhan *et al.* (2015), Jyothi *et al.* (2016) and Raundal *et al.* (2017), who reported the higher values of yield contributing character with higher application of N, P and K doses. Lower grain yield was recorded under wider spacing because total number of plants per unit area was far lesser than with closer spacing. Similar findings were also reported by Rajesh (2011) and Anitha *et al.* (2015). The date presented in Table 3 revealed that higher gross returns, net Returns and B:C ratio recorded in treatment receiving 125 % RDF with 30 cm row spacing (` 70492 $ha^{-1}$, ` 38914 ha^{-1} and 2.24, respectively) followed by 100% RDF with 30 cm row spacing (` 62687 $ha^{-1}$, ` 31492 ha^{-1} and 2.02, respectively). Lowest values were obtained in the treatment receiving 100% RDF with 45 cm row spacing (` 48657 $ha^{-1}$, ` 17568 ha^{-1} and 1.57, respectively). This could be due to the manifestation of higher grain and straw yields fetching of higher net returns at increased levels of fertilizer. The similar results are reported by Yadav *et al.* (2009), Jyothi *et al.* (2016) and Prakasha *et al.* (2017).

Interaction effects

Yield, yield attributes and economics of Brown top millet were not influenced by the interaction effect of dates of sowing, row spacing and fertilizer levels.

Conclusion

Brown top millet sown early on first fortnight of July recorded significantly higher yield attributes, grain yield, straw yield, gross returns, net returns and B:C ratio. Application of 125 per cent with 45 cm row spacing is advantageous in terms of individual plant performance.

Whereas, application of 125 per cent RDF with 30 cm row spacing was found economical on obtaining higher yield and net returns with high B:C ratio. Interaction effect of dates of sowing, row spacing and fertilizer levels were found to be non-significant with respect to yield attributes, yield and economics.

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References

Amanullah, J., Khan I., Amanullah S.A. and Sohail A. (2015). Sowing dates and sowing methods influence on growth, yield and yield components of pearl millet under rainfed conditions. *J. Environ. Earth Sci.*, **5(1)**, 2224-3216.

Anitha, D. (2015). Finger millet (*Eleusine coracana* L.) productivity as influenced by crop geometry and age of seedlings. *M. Sc. (Agri.) Thesis*. Acharya N. G. Ranga Agricultural University, Hyderabad, India.

Basavarajappa, R., Prabhakar A.S. and Halikatti S.I. (2002). Effect of tillage, organics, nitrogen and their interaction on yield attributes and yield of foxtail millet (*Setaria italica*) under shallow alfisols during rainy season. *Indian J. Agron.*, **47(3)**, 390-397.

Chouhan, M., Dinesh Kumar N., Gudadhe V., Vivek kumar S.V. and Hanwat R. (2015). Productivity, quality and nutrient uptake by summer pearl millet as influenced by transplanting dates and nitrogen levels. *Int. J. Environ. Sci.*, **6**, 325-329.

Clayton, W.D., Vorontsova M.S., Harman K.T. and Williamson H. (2006). Grass base-the online world grass. flora.http:// www.kew.org/ data/grasses-db.html.

Dapake, P.P., Chaudhari P.M., Ghodke S.K. and Patil M.R. (2016). Effect of sowing time and nutrient management on growth, yield and quality of pearl millet cv. dhanshakti under rainfed condition. *Contempary Research of India*, **7(3)**, 2137-2231.

Gavit, H.D., Rajemahadik V.A., Bahure G.K., Jadhav M.S., Thorat T.N. and Kasture M.C. (2017). Effect of establishment techniques and sowing time on yield and yield attributes of proso millet (*Panicum miliaceum* L.). *Int. J. Curr. Microbiol. Appl. Sci.*, **6(5)**, 1523-1528

Jyothi, K.N., Sumathi V. and Sunitha N. (2016). Productivity, nutrient balance and profitability of foxtail millet (*Setaria italica* L.) varieties as influenced by levels of nitrogen. *J. Agricult. Vet. Sci.*, **9(4)**, 2319-2380.

Kaushik, S.K. and Mahendra P. (1983). Response of pearl millet hybrids to nitrogen levels under irrigated conditions. *Indian J. Agron.*, **27(4)**, 435-436.

Kimata, M., Ashok E.G. and Seetharam A. (2000). Domestication, cultivation and utilization of two small millets, *Brachiaria ramosa* and *Setaria glauca* (Poaceae) in South India. *Economic Botany*, **54(2)**, 217-27.

Kumar, P.D., Sagar M., Tanmoy S. and Pushpalatha G. (2019). Effect of crop geometry and age of seedlings on productivity and nutrient uptake of finger millet (*Eleusine coracana* L.). *Int. J. Agricult. Environ. Biotech.*, **12(3)**, 267-272.

Lakshmi, P.M., Jaison S., Muthukumar T. and Muthukumar M. (2013). Assessment of metal accumulation capacity of *Brachiaria ramosa* collected from cement waste dumping area for the remediation of metal contaminated soil. *Ecological Engineering*, **60**, 96-98.

Maurya, S.K., Nath S., Patra S.S. and Rout S. (2016). Effect of different sowing dates on growth and yield of pearl millet (*Pennisetum glaucum* L.) varieties under Allahabad condition. *Int. J. Sci. Nat.*, **7(1)**, 62-69.

Mubeena, P., Halepyati A.S. and Chittapur B.M. (2019). Effect of date of sowing and nutrient management on nutrient uptake and yield of foxtail millet. *Int. J. Bio-resource Stress Manage.*, **10(1)**, 092-095.

Nigade, R.D., Jadhav B.S. and Bhosale A.S. (2006). Response of long duration finger millet (*Eleusine coracana* L.) variety to different levels of nitrogen under rainfed condition. *Int. J. Agricult. Sci.*, **7(1)**, 152-155.

Prakasha, G., Murthy K.N., Meti R.N., Jagadish and Prathima A.S. (2017). Nutrient uptake and economics of finger millet (*Eleusine coracana* L.) under guni method of planting in eastern dry zone of Karnataka. *Int. J. Pure Appl. Biol. Sci.*, **5(6)**, 144-151.

Rajesh, K. (2011). System of crop intensification in finger millet (*Eleusine coracana* (L.) Gaertn.) under irrigated condition. *M. Sc. (Agri.) Thesis*, TNAU, Coimbatore, India.

Ram, H.J.P., Singh J.S., Bohra J.S., Rajiv K.S. and Sutaliya J.M. (2014). Effect of seedlings age and plant spacing on growth, yield, nutrient uptake and economics of rice (*Oryza sativa* L.) genotypes under system of rice intensification. *Indian J. Agron.*, **59(2)**, 256-260.

Raundal, P.U., Pawar P.P., Musamade A.M., Mahajan M.S. and Desale S.B. (2017). Response of little millet varieties to different levels of fertilizers under rainfed condition. *Contemparary Research of India*, **4(1)**, 18-23.

Roopa, O.M. (2015). Nutritional evaluation and development of ready-to-cook mixes from brown top millet (*Panicum ramosa*). *M.sc.(Agri.), Thesis*. University of Agricultural Sciences, Bengaluru, India.

Saikishore, A., Rekha K.B., Hussain S.A. and Madhavi A. (2020). Growth and yield of brown top millet as influenced by dates of sowing and nitrogen levels. *Int. J. Chem. Stud.*, **8(5)**, 1812-1815.

Sheahan, C.M. (2014). Plant guide for browntop millet (*Urochloa ramosa*). USDA- Natural Resources Conservation Service, Cape May Plant Materials Center, Cape.

Siddiqui, D.A., Sharma G.K., Chandrakar T., Thakur A.K. and Pradhan A. (2020). Differential levels of fertilizer and row spacing affects growth and yield of brown top millet [*Brachiaria ramosa* (L.)] in entisols of bastar plateau zone of Chhattisgarh. *Int. J. Curr. Microbiol. Appl. Sci.*, **9(8)**, 3459-3472.

Upadhyay, P.N., Dixit A.G., Patel J.R. and Chavda J.R. (2001). Response of summer pearl millet to time and method of planting, age of seedling and phosphorus grown on loamy sand soils of Gujarat. *Indian J. Agron.*, **46(1)**, 126-130.

Yadav, H.S., Ahmad M.S. and Singh S.B. (2009). Phenotypic stability for grain yield and fodder yield in kodo millet. *Crop Res.*, **12(3)**, 343-348.