

Response of Kodo millet (*Paspalum scrobiculatum*) to varying levels of nitrogen under rainfed condition



Agriculture

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ABSTRACT

A field experiment entitled "Response of Kodo millet to varying levels of nitrogen under rainfed condition" was taken at JNKVV farm under AICRIP on small millets college of Agriculture, Rewa during Kharif season of 2007-08 and 2008-09. The study reveals that Kodo varieties GPK-3, RK 80 and JK 48 gave maximum grain yield and superior yield attributes as compared to R.K.-108 [local check]. The net income of Rs. 6988/ per hectare was maximum in GPK-3 followed by R.K.80 [Rs. 6516/ha]. The response of nitrogen was maximum at 40 kg N/ha. Increasing levels of nitrogen gave superior plant height, number of panicles per square meter, number of grains per panicle and test weight. The grain yield of kodo millet maximized [18.03 q/ha] by the application of 52.27 kg N/ha @ 16.43 kg grain per kg of nitrogen.

Introduction

Kodo millet occupies an area of 3.32 lakh hectare with the production of 0.65 lakh tones in the state of Madhya Pradesh. The kodo grain contains 8.3% protein, 1.4% fat, 65.6% carbohydrates & 2.9% ash. Kodo grain is recommended as a substitute for rice to patients suffering from diabetes diseases. Small millets are mostly used as rice or brand, which serve as the poor man's food.

The yield potential of kodo millet under rainfed area is very low i.e. 191 kg/ha because of practically negligible use of fertilizers, conventional cultivation of low yielding cultivars and lack of good management practices (Anonymous 2004). It is a common believe that small millets may not give profitable response to applied nutrients and other suitable management practices under rainfed conditions no doubt application of fertilizer become essential need for high yielding varieties of small millet to realize their maximum potential. The Indian soils have very low in nitrogen content because of tropical climate. Application of nitrogen in non-leguminous crops increases the grain yield and requires in large quantity. Yield of kodo millet has been found to increase by 10-75% to 34.11% due to application of 20-40 kg nitrogen per hectare as reported by Reja (2005), Thakur et al.(1999) and Dubey (1991).

The production of kodo millet is very low due to improper and imbalanced management practices and splitting doses of fertilizer. Research work on improved production technology of this crop is rather meager. Nitrogen requirement of kodo millet has not been estimated till now for rainfed conditions of Kymore plateau and Satpura hills of Madhya Pradesh.

Materials & Methods

The present experiment was taken at agriculture research farm, college of agriculture, Rewa (M.P.) under All India Coordinated Research Improvement Project on small millets during 2007-08 & 2008-09. The soil of the experimental field was sandy loam in texture, neutral in reaction (pH 7.1), low in available nitrogen (23 kg/ha) and phosphorus (9.6 kg/ha) and high in potassium (461 kg/ha). The treatment consisted of six varieties of kodo millet (RK 65-18, RK-80, R.K 92, JK 48, GPK 3 and R.K. 106 as local check) and three levels of nitrogen (N_0 -0 kg/ha, N_1 -20 kg/ha and N_2 -40 kg/ha).All the treatment combinations arranged in R.B.D. with three replications. The kodo millet crop was sown in first week of July during both the years in rows 25 cm apart and there after covered by loose soil immediately. All the recommended packages of practices were adopted as recommended for rainfed condition of Kymore plateau and Satpura hills of Madhya Pradesh.

Calculation of nitrogen response-

For calculation of N response of kodo millet the following quadratic regression equation was developed for pooled data.

$$Y = a + bx + cx^2$$

Where,

Y = yield

a, b and c are constants to be calculated

x is the interval of fertilizer dose i.e. 20 kg = 1 unit.

N- maxima

The maximize level of nitrogen in Kodo millet was calculated by following formulae

$$N\text{-maxima (kg/ha)} = \frac{-b}{2c} \times x$$

Where, X is the interval one unit = 20 kg.

Response of nitrogen-

The response of nitrogen in kodo millet was calculated by following

$$\text{Kodo response kg grain /kg of nitrogen} = \frac{bx - cx^2}{x}$$

Results and Discussion

Performance of varieties-

The growth and yield attributing characters of different varieties of kodo millet have been given in table 1. After perusal of the results it is clear that plant height was maximum in RK-80 followed by GPK-3. These varieties gave maximum number of tillers and productive tillers per square meter while number of grains per panicle was maximum in RK-106 (Local check). The variation in yield attributing characters in kodo millet varieties have also been reported by Singh and Arya (1994).

The grain and straw yield of different kodo varieties have been given in Table 2 which reveals that GPK-3 gave maximum grain yield 17.77 q/ha followed by RK-80 (16.80 q/ha) and JK-48 (16.66 q/ha). These varieties gave higher grain yield by 8.6% to 15.84% as compared to RK-106 (local check). The varieties RK-65 and RK - 92 gave lower yield by 3% to 10% as compared to RK-106. The net income of Rs. 6998 per hectare with B:C ratio 2.55 was maximum in GPK-3 followed by RK-80 (Rs. 6516/ha and 2.26). The kodo varieties GPK-3 and RK-80 gave higher grain yield as compared to RK-106 (local check). It is due to because of fact that these varieties gave superior plant height, more number of tillers and productive tillers per meter row length which had positive effect on grain yield of kodo millet. The similar results were also reported by Dwivision and Choudhary (2000).

Effect of Nitrogen-

The growth and yield attributes of millet are given in Table

1 reveals that plant height, number of panicles per square meter, number of grains per panicle and test weight of kodo millet were increased significantly with increasing levels of nitrogen and maximized at maximum tested dose i.e. 40 kg N/ha. The beneficial effect of nitrogen on growth and yield attributing characters of kodo millet has also been reported by Singh and Arya (1995), Singh et al. (1996), Annual report (2002-03).

The grain and straw yield of kodo millet have been given in Table 2 reveals that response of nitrogen was linear and quadratic.

The grain yield data was subjected to single degree of freedom analysis on which linear and quadratic relationship were found significant. To find out the effect of nitrogen on kodo millet quadratic regression equation was worked out. The grain yield (18.03q/ha) was maximized at 52.27 kg nitrogen per hectare @ 16.43 kg grain per kg of nitrogen (Table 3). The net profit of Rs. 7140/ha was maximum at 40 kg N/ha with B:C ratio 2.33. The increasing levels of nitrogen had positive effect on growth and yield attributes of Kodo millets which ultimately increased the grain yield. Singh 2002 had also reported the positive effect nitrogen on growth and yield of Kodo millet.

Table -1 Growth characters of kodo millet as influenced by different varieties and applied N level

Treatments	Plant Population(m ²)	Plant height (cm)	Number of tillers/m ²	Number of panicles/ m ²	Number of panicles/ cm	Number of grains/ panicles	Test weight (g)
Varieties							
RK 65-18	78.33	59.15	299.07	326.77 (131.58%)	5.94 (99.33%)	177.02 (92.84%)	4.51
RK 80	77.00	74.64	359.27	356.88 (143.75%)	6.17 (103.17%)	146.26 (76.71%)	4.25
RK 92	77.66	62.57	333.33	328.44 (133.25%)	6.35 (106.18%)	146.26 (76.71%)	4.31
RK 48	77.66	68.68	331.66	327.99 (132.07%)	6.80 (113.71%)	164.42 (86.24%)	4.80
GPUK 3	75.77	72.68	383.88	380.33 (153.15%)	6.47 (108.19%)	166.48 (87.32%)	4.91
RK 106 (local check)	77.33	66.06	250.44	248.33 (0.00)	5.98 (0.00)	190.66 (0.00)	4.37
S.E. m±	1.455	0.850	2.092	9.172	0.079	3.195	0.068
C.D. (5%)	NS	2.442	26.101	26.332	0.228	9.173	0.195
Nitrogen levels (N kg/ha)							
N ₀	77.16	63.68	297.31	294.33	5.94	152.42	4.17
N ₂₀	77.72	66.63	331.98	330.83	6.33	166.12	4.57
N ₁₀₀	77.00	71.58	349.26	358.55	6.58	175.51	4.84
S.E. m±	1.029	0.60	6.429	26.486	0.056	2.259	0.048
C.D. (5%)	NS	1.726	18.450	18.62	0.61	6.487	0.138

Figures in parentheses are % over RK-106 .

Table -2 Yield and net return for kodo millet varieties and applied N level

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)	Net income (Rs./ha)	B:C ratio
Varieties					
RK 65-18	13.81 (90.02%)	20.83	40.09	4429	1.86
RK 80	16.80 (109.5%)	25.69	39.66	6516	2.26
RK 92	15.00 (97.78%)	22.50	39.88	5239	2.01
RK 48	16.66 (108.60%)	22.36	43.46	6229	2.21
GPUK 3	17.77 (115.84)	24.02	42.53	6998	2.55
RK 106 (local check)	15.34 (0.00)	19.16	44.65	5297	2.01

S.E. m±	0.413	1.252	1.536	-	-
C.D. (5%)	1.187	3.594	NS	-	-
Nitrogen levels (N kg/ha)					
N ₀	13.95 (0.00)	19.58	41.79	4658	1.94
N ₂₀	15.45 (110.75%)	22.84	40.72	5330	2.07
N ₁₀₀	1829 (131.11%)	24.86	42.62	7140	2.33
S.E. m±	0.292	0.885	01.086	-	-
C.D. (5%)	0.839	2.541	NS	-	-

Table.3 Response of N on grains yield of Kodo millet

Regression equation	Response kg/ grain/ kg of N	N –maxima (kg N/ha)	Yield at X-maxima (q/ha)
Quadratic $y = 13.5 + 3.43x - 0.65x^2$	16.43	52.76	18.03

REFERENCE

Annual report 2002-2003. Response of pre-release varieties of Kodo millet to Nitrogen levels under rainfed conditions. Annual report, All India Coordinated Small Millet Improvement Project, college of agriculture, Rewa (M.P.). | Dubey, O.P. 1991. Response of Kodo millet (*Paspalum scor-biculatum*) genotypes on nitrogen levels under skeletal soils. Indian J. Agron. 36 (4): 598-599. | Dwivision, R.K. and Choudhary, S.K. 2000. Performance of Kutki varieties under different nitrogen levels. Current research 29 (7-8): 120-121. | Reja, Satish Kumar 2005. Response of pre-released promising varieties of kodo millet on different levels of nitrogen under rainfed condition. J.N.K.V.V., College of Agriculture, Rewa (M.P.). | Sain, J. P; Negi, S.C. and Singh, C.M. 1996. Response of finger millet genotypes to nitrogen application under desert conditions. Indian J. Agron. 41 (1): 61-64. | Singh, R. V. and Arya, M.P.S. 1995. Nitrogen requirement of barnyard millet (*Echinochloa frumentace*) + pulse intercropping systems. Indian J. Agron 40(2): 172-175. | Singh, R.V. and Arya, M.P.S. 1994. Response of finger millet (*Eleusine coracana*) varieties to nitrogen under rainfed condition. Indian J. Agron. 39 (1): 125-128. | Singh, R.V. 2002. Response of finger millet (*Eleusine coracana*) varieties to nitrogen under rainfed condition. Ann. Agric. Res. New series 23 (2) : 343-345. | Thakur, N.S.; Pannase, S. K; Sawarkar, S. D. 1994. Economics of Kodo millet for high hills of Satpura plateau zone of Madhya Pradesh, India International journal of Tropical Agriculture, 12 (1-2): 36-38.