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DIFFERENT BAJRA STRAINS FOR FODDER YIELD AND QUALITY

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INTRODUCTION

Bajra (*Pennisetum typhoides*) is quick growing, short duration fodder crop which attributes high tillering capacity, high yield at low doses of fertilization and quite safe in feeding at any stage of growth as reported by Krishnaswami (1962), Reddy and Rao (1967) and Relwani (1973). It is high yielding type (Goswami *et al.*, 1971; Raju and Relwani, 1971) and low level of oxalic acid (Sehgal and Goswami, 1969) which make it an excellent forage.

A large number of strains are in the advanced stage of testing under All India-Co-ordinated Millet Improvement Project. In the present study, a three year consecutive field trial was taken up with most promising strains of bajra alongwith well established varieties to investigate their performances for fodder yield and quality.

MATERIAL AND METHODS

Experiments were laid out in the field as per the plan and programme supplied by the co-ordinator. Sowing was done with 22, 21 and 24 entries on May 7, 1973; July 9, 1974 and July 18, 1975 respectively. The seeds were sown in 5 lines at 45 cm apart in row in the plots of 8.10 m^2 size. The manuring consisted of 25 metric tonne of farmyard manure, 50 kg N, 40 kg P_2O_5 and 30 kg K_2O/ha. Nitrogen at 30 kg/ha alongwith full dose of P_2O_5 and K_2O was applied at seeding and the remaining 20 kg N after one month of emergence of plants. The crop was irrigated 2-3 times during summer and no irrigation was given during monsoon period. The experiments were conducted in randomized block design with 4 replications in 1973 and 3 replications in 1974 and 1975 respectively. The crop was harvested on July 22, 1973; September 19, 1974 and September 30, 1975.

The physico-chemical characteristics of the soil was clay loam in texture, neutral pH (7.3), medium in available N, P_2O_5 and organic carbon. Plant samples were analysed in all varieties for dry matter (70°±2°C) to a constant weight, crude protein by Kjeldahl method (AOAC, 1960) and multiplying by a factor 6.25, ether extract (EE) by Soxhlet method (AOAC, 1960), acid detergent fibre (ADF) by following Van Soest (1963), cellulose by Crampton and Maynard (1938), oxalic acid by precipitation as Ca-oxalate, ash by dry ashing of the samples in muffle furnace (600°±5°C), minerals (Ca, Mg, P) by wet digestion (9:1:3, HNO_3 : H_2SO : HCl) and determination of Ca and Mg was done by EDTA complexometry and P by vanadomolybdo yellow colour method (USDA, 1954) and digestible cellulose by using nylon bag according to Lusk *et al.* (1962) in the rumen of the fistulated Murrah buffalo for 24 hr.

The yield data were analysed statistically. The biometrical observations were also taken after harvest of the crop at initiation of flowering stage.

RESULTS AND DISCUSSION

Yields of green fodder, dry matter and crude protein of different bajra strains for

1973, 1974 and 1975 are represented in Tables 1-3. The data for quality parameters *viz.* EE, ADF, cellulose, ash, oxalic acid, mineral composition and digestible cellulose are recorded in Table 4. In 1973, varieties HB4 (F_2) and K 622 yielded 1218 and 1097 q/ha respectively and however, only the former was significantly superior to the remaining varieties. Again, varieties like Anand, D 1941, L 72 (NB/72), TF 23A×R91, K 677, Kanpur and Composite-D did not differ significantly from K 622. The variety HB 4 (F_2) produced highest dry matter yield of 209.3 q/ha and was statistically at par with TF 23A × R 91, TF 23A × R 117, D 1941, Anand, HB1 (F_2), L 72 (NB/72) and Kanpur, but significantly superior to the remaining varieties. It may further be observed that the existing improved varieties A 1/3 and S 530 have yielded the lowest dry matter of 118.8 and 118.0 q/ha respectively. The results on crude protein content indicate the superiority of S 530 (12.75), K 674 (12.33), F 1284 (11.8), HB 3 (F_2) (11.5), A 1/3 (11.4) and Composite-D (11.4) as compared to the rest varieties and with regard to total out-turn of crude protein per hectare HB 3 (F) outyielded all the above mentioned varieties with a yield of 19.47 q/ha. However, Composite-D, L 72 (NB/72) and HB 4 (F_2) produced crude protein at par.

The yield attributes that contributed to higher green and dry matter yields produced by HB 4 (F_2) were due to more number of leaves per tiller (14.1), length of longest leaf (92.6 cm) and circumference of main stem (5.2 cm). It also showed moderately high with regard to

TABLE 1

Average green, dry matter and crude protein yields, and dry matter and crude protein per cent of bajra strains in 1973

Strains	Green yield (q/ha)	Dry matter yield (q/ha)	Dry matter (%)	Crude protein yield (q/ha)	Crude protein (%)
HB 4 (F_2)	1,218	209.3	18.32	17.2	8.75
K 622	1,097	164.3	17.09	15.0	10.40
Anand	1,075	183.3	14.35	17.0	7.83
D 1941	1,059	190.4	17.35	18.0	9.10
L 72 (NB/72)	1,018	177.8	18.40	17.5	10.35
TF 23A×R 91	993	198.9	17.30	20.0	8.70
K 677	990	154.7	16.45	15.6	10.63
Kanpur	990	175.9	15.62	17.8	8.88
Composite-D	971	166.3	18.92	17.1	11.38
HB 3 (F_2)	958	169.3	19.47	17.7	11.50
TF 23A×R 117	947	195.6	15.32	20.7	7.83
K 559 (F_2)	925	167.4	14.86	18.1	8.88
D 2291	892	163.8	17.61	18.4	10.75
F 848	883	163.0	14.86	18.5	9.03
HB 1 (F_2)	883	180.8	15.60	20.5	8.63
F 1284	834	149.5	17.64	17.9	11.80
A.P. Complex	828	163.8	15.81	19.8	9.65
SYN 53.7	823	139.4	13.14	16.9	9.43
K 674	796	141.0	17.39	17.7	12.33
S 530	782	118.0	15.04	15.0	12.75
A 1/3	757	118.8	13.58	15.7	11.43
K 249	691	124.8	12.52	18.1	10.03
CD at 5%	137	34.3	2.96	—	—

TABLE 2

Average green, dry matter and crude protein yields, and dry matter and crude protein per cent of bajra strains in 1974

Strains	Green yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)	Dry matter (%)	Crude protein (%)
D 1941	845	186.3	13.72	22.0	7.36
K 677	837	168.4	10.70	20.1	6.35
K 622	818	155.3	10.07	19.0	6.48
HB 5	790	130.3	10.15	16.5	7.79
LAM. SYN	787	144.6	10.07	18.4	6.96
S 530	746	119.6	11.99	16.0	10.03
F 848	722	115.8	10.78	16.0	9.31
VIZ	719	127.0	8.86	17.7	6.98
A 296	708	126.7	11.17	17.9	8.82
D 2291	653	136.1	9.60	20.8	7.05
HB 1	639	105.3	7.22	16.5	6.86
A 1/3	636	131.7	7.60	20.7	5.77
TF 23A×R 117	626	94.4	7.05	15.1	7.47
TF 23A×R 91	626	114.4	8.70	18.3	7.60
HB 3	609	90.3	7.87	14.8	8.72
Composite-D	604	103.3	8.23	17.1	7.97
K 559	582	116.3	7.76	20.0	6.67
F 1284	568	95.2	6.94	16.8	7.29
SYN 53/7	461	71.1	6.50	15.4	9.14
A 125	458	93.3	6.39	20.4	6.85
K 674	412	89.2	5.49	21.7	6.15
CD at 5%	164.3	37.17	3.18	—	—

number of tillers per linear metre (28), height of plant (197 cm) and breadth of longest leaf (3 cm). The growth parameter in favour of K 622 were 93.4 and 3.9 cm in relation to length and breadth of longest leaf respectively. Anand excelled the highest number of tillers per linear metre row length (36) and length of longest leaf (99.7) cm). Maximum height of tiller at the harvest were observed with strains TF 23A × R117 (252 cm), Kanpur and D 1941 (248 cm). D 1941 indicated greater breadth (4 cm) and more number of leaves per tiller (13.8).

During the year 1974, strains D 1941, K 677, K 622, HB 5, LAM. SYN, S 530, F 848, VIZ and A 296 outyielded the remaining and were at par among themselves in green yield. The dry matter per cent of all the varieties varied within 14.8—22.0 range. The corresponding dry matter yield showed promising results in case of D 1941, K 677, K 622, HB 5, LAM. SYN, D 2291 and A 1/3 as compared to other strains. However, D 1941, K 677 and K 622 remained at par. The highest crude protein yield per hectare were shown by D 1941, S 530, F 848, K 677, and A 296. Strain K 622, which was performing well in green matter production, could not reach the level of significance due to

TABLE 3

Green, dry matter and crude protein yields, and dry matter and crude protein per cent obtained in 1975

Strains	Green yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)	Dry matter (%)	Crude protein (%)
PHB 14	652.3	119.0	8.77	18.2	7.37
PHB 12	578.3	116.4	8.36	20.1	7.18
Composite-D	573.5	110.4	8.77	19.2	7.94
A 296	549.6	106.1	8.05	19.3	7.59
Hyb. L. 234 (F_2)	485.1	104.9	7.65	21.6	7.29
L 74	454.0	95.3	6.76	17.5	7.09
VIZ	430.1	73.4	5.90	17.1	8.04
D 1941	425.3	84.6	6.52	19.9	7.71
UPFB 1	422.9	80.5	5.57	19.0	6.92
L 72	422.9	101.6	6.62	24.0	6.52
KF 249	418.2	96.8	6.86	23.1	7.09
K 677	413.4	81.5	5.81	19.7	7.13
S 530	394.3	88.7	6.38	22.5	7.19
PHB 10	387.1	65.0	5.42	16.8	8.34
A.P. Complex	351.3	71.2	5.02	20.3	7.05
A 1/3	346.5	66.9	5.09	19.3	7.61
NHB 3	339.3	74.3	5.09	21.9	6.85
K 674	315.4	66.9	4.30	21.2	6.43
UPFB 5	310.6	73.8	4.95	23.7	6.71
K 672	305.9	60.9	4.23	19.9	6.95
NHB 5	305.9	62.1	4.37	20.3	7.04
SYN 53/7	298.7	66.4	4.71	22.2	7.09
K 622	267.6	50.9	3.58	19.0	7.03
D 2291	262.8	45.6	3.58	17.3	7.85
CD at 5%	217.9	42.5	N.S.	—	—

lower dry matter and crude protein contents. On the other hand, strains S530 and F848 were at par with the top yielder due to highest crude protein per cent. The yield attributing characters like number of leaves per tiller, breadth of longest leaf, height of plant, length of longest leaf and number of tillers per linear metre were found to be higher with D 1941 variety and the values recorded were 12.4, 5.1 cm, 215 cm, 78.8 cm and 20, respectively. Hence, it may be ascertained that these growth factors enhanced green and dry matter yields produced by this variety. K 677 occupied second position in green and dry matter production which recorded breadth of longest leaf and number of tillers per linear metre of 5 cm and 23 respectively. In cases of varieties K622 the tiller height of 243 cm, S 530 longest leaf of 89.8 cm and number of tiller per row metre length (29) with F 848 were observed as maximum, though they did not compete with D 1941.

In the year 1975, New Hybrid Bajra, Punjab Hybrid Bajra and U.P. Fodder Bajra were included in the trial to test their performance against existing bajra varieties of S 530 and A 1/3. The strains, which appeared promising in the second year, were also included in this

TABLE 4

Average chemical composition and digestibility of cellulose of different bajra strains (per cent on oven dry basis)

Strains	EE	Ash	Ca	P	Mg	Oxalic acid	ADF	Cellulose	Digestible cellulose
S 530	2.37	14.4	0.44	0.29	0.36	1.17	38.8	36.3	68.8
K 674	2.33	13.2	0.42	0.22	0.26	1.56	37.2	33.1	32.0
F 1284	1.33	14.6	0.59	0.31	0.38	1.38	40.4	34.9	32.8
HB 3 (F_2)	1.90	15.4	0.48	0.25	0.36	1.89	38.0	40.1	32.5
A 1/3	1.16	14.7	0.46	0.28	0.34	1.17	44.1	38.4	37.3
Composite-D	1.71	12.8	0.45	0.21	0.31	1.80	36.1	38.3	35.7
D 2291	1.60	11.8	0.58	0.29	0.31	1.74	38.2	39.3	45.9
K 677	1.83	14.1	0.48	0.23	0.29	1.74	42.0	39.9	43.2
K 622	2.16	15.2	0.51	0.28	0.24	1.68	39.0	37.6	23.0
L 72 (NB/72)	2.47	12.9	0.36	0.19	0.28	1.50	36.2	39.4	51.0
K 249	2.72	13.4	0.39	0.24	0.28	2.01	35.6	35.0	46.7
A.P. Complex	2.19	12.2	0.38	0.22	0.22	1.38	40.7	37.7	45.4
SYN 53/7	1.99	13.7	0.49	0.26	0.34	1.65	45.5	36.1	28.2
D 1941	1.49	13.8	0.48	0.23	0.39	1.29	40.3	38.4	44.1
F 848	1.55	12.4	0.54	0.29	0.37	1.50	39.8	40.2	38.2
K 559 (F_2)	2.01	13.7	0.46	0.26	0.26	1.71	36.7	37.1	21.9
Kanpur	2.21	15.1	0.41	0.20	0.22	1.29	42.9	39.0	44.6
HB 4 (F_2)	2.29	14.6	0.39	0.20	0.28	1.77	36.7	36.4	47.0
TF 23A×R 91	1.72	12.5	0.39	0.25	0.29	1.08	30.5	38.2	33.5
HB 1 (F_2)	1.23	12.4	0.46	0.24	0.31	1.23	35.4	38.6	44.2
TF 23A×R 117	1.86	12.1	0.38	0.21	0.30	1.05	38.1	40.3	39.4
Anand	1.53	14.6	0.35	0.24	0.28	1.89	37.4	39.1	43.3

trial. The best performance was shown by PHB 14, however, it was at par with PNB 12, composite-D, A296, Hyb. L. 234 (F_2) and L 74 in green yields and with PHB 12, Composite-D, A 296, Hyb. L 234 (F_2) and L72, KF 249, L 74, D 1941 and K 677 in dry matter. The highest crude protein contents were shown by PHB 10, VIZ, and Composite-D, whereas, highest crude protein yield was recorded by PHB 14 and Composite-D followed by PHB 12. The difference in crude protein production per hectare was not statistically significant among different strains.

Thus from the results obtained during the period of 3 years it can be concluded that in the first year HB 4 (F_2) produced highest green and dry matter yields, but could not maintain its position in crude protein production. The next best strain K 622 in green metter production could not appear to be consistently better in the subsequent year. In the second year strains D 1941, K 677 and K 622 showed higher green and dry matter production, but only the former could produce maximum crude protein. The other strains which consistently showed high crude protein out turn per hectare were S 530, F 848, A 296 and K 677. None of other entries were found to be superior over D 1941 and K 677. In the third year, new entries PHB 14, PHB 12 and Composite-D showed better performance in green, dry matter and crude protein yields.

Twenty two bajra strains were studied in relation to quality and mineral composition.

Ether extract values were 1.6-2.72% in A 1/3 and K 249 varieties, respectively and the remaining were ranged between 1.23 and 2.47%. TF 23A × R 91 and SYN 53/7 recorded acid detergent fibre percentage of 30.5 and 45.5 respectively, whereas the other strains varied between 35.4 and 44.1%. Lowest cellulose content was obtained in K674 (33.1) and the highest (40.1) in case of TF 23A × R 117. Variety HB 3 (F_2) yielded ash in the order of 15.4% which excelled the highest among all strains. With regard to Ca, Mg and P content the values were 0.35—0.58, 0.22—0.39 and 0.19—0.29% respectively in all the species. Two strains TF 23A × R 117 and TF 23A × R 91 showed lower oxalic acid concentration than existing improved strains of S 530 and D 1/3. The common parent TF 23A in both these crosses appeared to be low in oxalic acid due to which both the varieties exhibited low oxalic acid content. The existing variety S 530 showed the highest digestibility of cellulose (68.8%) followed by L 72 (NB/72), HB 4 (F_2) and K 249. The various chemical composition data recorded is supported with the findings of earlier works reported by Patel *et al.* (1958), Sehgal and Goswami (1969), Raju and Relwani (1971) and Singh *et al.* (1974).

SUMMARY

Experiments were conducted in the year 1973, 1974 and 1975 taking 21, 22 and 24 bajra strains respectively to study the performances of these for forage yield and quality. The results indicated that in the first year HB 4 (F_2) produced highest green and dry matter yields. The next best varieties K622, D1941 and K677 showed promising yields and D1941 yielded maximum crude protein in the second year. Entries like S530, F848 and A296 also produced crude protein at higher range. In the third year PHB 14, PHB 12 and Composite-D performed well. With regard to quality, K 249 recorded 2.72% EE and TF 23A × R91 showed 30.5% ADF, the values which were in favourable order. Lowest cellulose (33.1%) was observed with K674, and crosses with 23A parent contained minimum oxalic acid. HB 3 (F_2) yielded high ash, and the value obtained was 15.4%. Calcium, magnesium and phosphorus content varied within normal range in all the strains, and highest digestible cellulose was observed in case of S 530 (68.8%).

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