

RELATIVE PROFITABILITY OF DUAL PURPOSE MAIZE PRODUCTION

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(Received : 8 March 2020; Accepted : 22 March 2020)

SUMMARY

An experiment was carried out during 2016-2017 at the Instructional-cum-Research (ICR) Farm, Assam Agricultural University, Jorhat to study the effect of relative profitability of dual purpose maize production. The experiment was laid out in a randomized block design (RBD) with eight treatments replicated thrice. In this experiment maize were grown at different inter-row and intra-row spacing for grain (T_1) at a spacing of 60 cm \times 30 cm, fodder (T_2) at 30 cm \times 15 cm. Fodder cum grain crop at 30cm \times 30 cm with removal of alternate rows at knee-high stage (T_3), tasseling stage (T_4) and milking stage (T_5) for fodder. Fodder cum grain crop at 30 cm \times 15 cm with removal of alternate rows at knee-high stage (T_6), tasseling stage (T_7) and milking stage (T_8) for fodder. Two levels of fertilizer viz., F_1 : 100 % recommended dose of fertilizer and F_2 : 150% of recommended dose of fertilizer. The crop management practice T_7 recorded the highest gross return (Rs. 1,20,951/ha) and crop management practice T_1 recorded the highest net return (Rs. 90,631/ha) followed by crop management practice T_7 (Rs. 83,333/ha). Among the fertilizer level F_2 : 150% of recommended dose of fertilizer recorded highest gross return (Rs. 1,05,543/ha) and highest net return (Rs. 70,650/ha). The highest Benefit: Cost ratio of 4.46 was, however, found in grain crop sown at a spacing of 60cm \times 30 cm (T_1) and was almost equal (3.22) to the high density (30 cm \times 15 cm) fodder cum grain crop followed by removal of alternate rows at tasseling stage for fodder (T_7). The highest Benefit: Cost ratio (3.02) in terms of levels of fertilizer was found in 150 per cent of recommended dose of fertilizer.

Key words : Maize, knee- high stage, tasseling stage, milking stage

Maize is one of the most widely grown cereals in the world and has great significance as human food, animal feed and raw material for large number of industrial products. In India, about 50 to 55 per cent of the total maize production is consumed as food, 30 to 35 per cent goes for poultry, piggery and fish meal industry and 10 to 12 per cent to wet milling industry (Thakur *et al.* 2015). Increasing growth of livestock need supply of high quality fresh fodder. Under this situation, dual purpose maize can be a good option that can maintain the supply of fodder to the burgeoning livestock population of the country. Maize as a dual purpose crop which provides cobs for human consumption and fodder for livestock (Dar *et al.* 2014).

Among the different agronomic practices, plant density is one of the most important factor determining grain yield and other agronomic attributes of maize. There is an optimum plant density for each crop. Under low plant density, although single-plant production increases, yield per unit area decreases. On the other hand, excessive density can increase the competition and decrease the yield (Dar *et al.* 2014).

Nutrient requirement is the most important for the growth and yield of maize. Ideal nutrient management optimizes grain yield, farm profit. Keeping all this in view the present experiment was conducted to find the planting density and nutrient requirement for maximising growth, yield and economic returns of dual purpose maize.

MATERIALS AND METHODS

The experiment was conducted at the Instructional-Cum-Research Farm of Assam Agricultural University during 2016-17 on a sandy loam soil having 210.65 kg N ha⁻¹, 38.64 kg ha⁻¹ of available phosphorous and 295.55 kg ha⁻¹ available potassium. The pH of the soil was 5.15. The experiment was laid out in factorial randomized block design and replicated thrice. The treatment consisted of eight crop management practices viz., Grain crop at 60 cm x 30cm (T_1), Fodder crop at 30 cm x15 cm (T_2) harvested at tasseling stage, Fodder cum grain crop at 30 cm x 30 cm with removal of alternate rows at knee-high stage

for fodder (T_3), Fodder cum grain crop at 30 cm x 30 cm with removal of alternate rows at tasseling stage for fodder (T_4), Fodder cum grain crop at 30 cm x 30 cm with removal of alternate rows at milking stage for fodder (T_5), Fodder cum grain crop at 30 cm x 15 cm with removal of alternate rows at knee-high stage for fodder (T_6), Fodder cum grain crop at (30 cm x 15 cm) with removal of alternate rows at tasseling stage for fodder (T_7), Fodder cum grain crop at 30 cm x 15 cm with removal of alternate rows at milking stage for fodder (T_8) and two levels of fertilizer viz., F_1 : 100% of recommended dose of fertilizer and F_2 : 150% of recommended dose of fertilizer. [NB: Recommended Dose of Fertilizer (RDF) = 60-40-40 N- P_2O_5 - K_2O kg ha⁻¹ (Package of practices for rabi crops of Assam, 2009)]

The dual purpose maize hybrid variety PAC 751 was taken as test crop for assessing its performance. The seed was sown on a well prepared seedbed. Quantity of seeds required for different treatment was calculated and sowing was done in lines at spacing of 60 cm x 30 cm, 30 cm x 30 cm and 30 cm x 15 cm. The size of individual plot is 12 m². For the individual plot spacing 60 cm x 30cm, number of rows of plants are 6 and for spacing 30 cm x 30 cm and 30 cm x 15 cm, number of rows of plants are 13. At the time of final land preparation, well decomposed farm yard manure @ 5 t/ha was applied in the field and thoroughly incorporated before laying out the experiment. The total quantity of P and K and one-third (?) of nitrogen at sowing was manually applied and remaining two-third (?) of N in two equal doses at knee-high stage and at tasseling was applied as per treatment. Harvesting of fodder maize was done at different stage (knee-high stage, tasseling stage and milk stage) in alternate rows as per treatments. All other agronomic practices were kept normal and uniform for all the treatments. Crude protein content of fodder maize was calculated by multiplying the percentage of nitrogen content of the fodder maize with the conversion factor 6.25 (Piper, 1966). The crude protein yield (q/ha) was calculated by taking the product of per cent crude protein content and corresponding dry matter yield (q/ha). Considering the price of the green fodder, price of the maize cob with husk, yield of fodder maize and cob yield with husk grain equivalent yield of green fodder was calculated by using the following formula :

Grain equivalent yield (q/ha) = Cob yield with husk (q/ha) + Yield of fodder maize (q/ha) x Fodder price (Rs./q)/Cob price (Rs./q)

Cost of cultivation was calculated per hectare basis for each treatment by taking into accounts the prevailing cost of inputs, labour and operational cost. Gross return was the value of the economic yield calculated at prevailing market price. Net return was calculated by subtracting the cost of cultivation from the gross return on per hectare basis.

Net return = Gross return – Cost of cultivation

Benefit cost ratio was computed dividing net return by total cost of cultivation. Data on agro-economic aspects of the crop were recorded and were analysed statistically adopting the procedure of analysis of variance given by Cochran and Cox (1962) and differences among treatment means were tested using t-test at 5% level of significance.

RESULTS AND DISCUSSION

Plant height is an important component which helps to determine the growth attained during the crop period. Crop management practices applied at different growth stages of maize recorded significant variation in plant height (Table 1). Significantly the highest plant height of 212.4cm and 221.7cm at 60 and 90 DAS, respectively was recorded by the grain crop sown at a spacing of 60cm x 30cm (T_1), which remained at par with fodder cum grain crop sown at a spacing of 30cm x 30 cm with removal of alternate rows at knee-high stage for fodder (T_3). The lowest plant height of 168 cm and 179 cm at 60 and 90 DAS, respectively was recorded in crop management practice T_8 (Fodder cum grain crop sown at 30cm x 15cm spacing and removal of alternate rows at milking stage for fodder). This might be due to less intra-specific competition for space, sunlight, moisture and available nutrients in grain crop grown at recommended spacing of 60cm x 30cm (T_1) as well as in T_3 where high density plant population was maintained for a very short period where the inputs may not fall short of the critical limit. The reduction in plant height in T_8 crop management practice was due to crowding effect of the plant and higher intra specific competition for resources for longer period. This trend explains that as the number of plants increased in a given area the competition among the plants for nutrients uptake and sunlight interception also increased as observed by Sangakkara *et al.* (2004). Similar result was also reported by Bahadur *et al.* (1994), where they recorded higher plant height of maize under wider spacing as compared to that of closer spacing.

TABLE 1
Effect of crop management practices and levels of fertilizer on plant height (cm) and crop phenology of dual purpose maize

Treatment	Plant height (cm) at			Days to 50% tasseling	Days to 50% silking
	30 DAS	60 DAS	90 DAS		
Crop management (T)					
T ₁ : Grain (G)	56	212	221	71.67	76.17
T ₂ : Fodder (FD)	59	173	-	72.17	-
T ₃ : F at KHS* with S ₁ +G	62	195	207	71.83	77.50
T ₄ : F at TS with S ₁ +G	62	185	200	71.50	76.67
T ₅ : F at MS with S ₁ +G	60	183	194	72.50	77.33
T ₆ : F at KHS with S ₂ +G	62	181	192	71.00	76.50
T ₇ : F at TS with S ₂ +G	65	171	185	72.33	77.33
T ₈ : F at MS with S ₂ +G	59	168	179	72.33	76.83
S. Em±	2	4	5	0.41	0.41
C. D. (P=0.05)	NS	12	15	NS	NS
Levels of fertilizer (F)					
F ₁ (100% of RDF)	59	178	192	71.92	76.9
F ₂ (150% of RDF)	62	188	202	71.92	76.9
S. Em±	1	2	2	0.21	0.22
C. D. (P=0.05)	NS	6.06	8	NS	NS
Interaction (T × F)					
S. Em±	2.58	4.2	5.21	0.41	0.41
C. D. (P=0.05)	NS	NS	NS	NS	NS

*KHS : Knee-high Stage, TS : Tasseling Stage, MS : Milking Stage, S₁ : 30 cm x 30 cm spacing and S₂ : 30 cm x 15 cm DAS=Days after sowing, CD= Critical difference, RDF= Recommended dose of fertilizer

The plant height, which is the index of general growth of the plant showed significant improvement at different crop growth periods with enhancement in levels of fertilizer. The plant height was found to be significantly higher under F₂ (N- P₂O₅-K₂O @ 90- 60- 60 kg ha⁻¹) than under F₁ (N- P₂O₅-K₂O @ 60- 40-40kg ha⁻¹). Increased plant height with increasing doses of N was reported by Paradkar and Sharma, 1993. Increasing doses of fertilizer up to 180-120-80 N-P₂O₅-K₂O kg ha⁻¹ induce plant height in maize have also been reported by Singh *et al.* 1995. Adaption of different crop management practices and fertilizer levels did not show any significant variation in number of days to reach 50 per cent tasseling and silking stages.

Significant variations in fodder parameter were recorded due to different crop management practices. Green fodder yield (164.04q ha⁻¹), crude protein content (8.781) and crude protein yield (3.11 q ha⁻¹) were significantly highest in fodder crop sown at spacing of 30cm x 15cm (T₂) over all other crop management practices (Table 2). In this practice all the maize plants were harvested for fodder purpose at tasseling stage. But other crop management practices only alternate rows were harvested for fodder purpose at different growth stages. The crop rectangularity (30cm × 15cm) and plant density (2,22,222 plants ha⁻¹) resulted from this spacing might be optimum to result in better light absorbance by more number of flag leaves which have higher photosynthesis efficiency and enhanced green fodder

TABLE 2
Effect of crop management practices and levels of fertilizer on yield and quality of fodder of dual purpose maize

Treatment	Green fodder (q/ha)	Crude protein content (%)	Crude protein yield (q/ha)
Crop management (T)			
T ₁ : Grain (G)	-	-	-
T ₂ : Fodder (FD)	164.04	8.781	3.11
T ₃ : F at KHS* with S ₁ +G	12.13	8.606	0.18
T ₄ : F at TS with S ₁ +G	63.90	8.609	1.02
T ₅ : F at MS with S ₁ +G	74.18	8.644	1.40
T ₆ : F at KHS with S ₂ +G	21.76	8.675	0.34
T ₇ : F at TS with S ₂ +G	78.31	8.738	1.39
T ₈ : F at MS with S ₂ +G	87.15	8.758	1.57
S. Em±	3.72	0.23	0.09
C. D. (P=0.05)	10.80	NS	0.26
Levels of fertilizer (F)			
F ₁ (100% of RDF)	63.59	8.645	1.13
F ₂ (150% of RDF)	79.68	8.730	1.45
S. Em±	1.99	0.12	0.05
C. D. (P=0.05)	5.79	NS	0.14
Interaction (T × F)			
S. Em±	3.72	0.23	0.09
C. D. (P=0.05)	NS	NS	NS

*KHS : Knee-high Stage, TS: Tasseling Stage, MS: Milking Stage, S₁: 30 cm x 30 cm spacing and S₂: 30 cm x 15 cm.

yield as described by Tetio-Kagho and Gardnar (1988). Application of 50 per cent higher fertilizer over recommended level resulted in significantly higher green fodder yield (79.68 q ha⁻¹), crude protein content (8.730 %) and crude protein yield (1.45 q ha⁻¹) (Table 2). This

might be due to the fact that the maize has the capacity to utilize all applied levels of fertilizer since maize crop is a heavy feeder of nutrients. This was in conformity with Aslam (2007), who observed maximum green fodder yield with 150kg N ha⁻¹. Sahoo and Panda (2001) reported that green fodder yield of maize increased with increasing levels of fertilizer. Significantly higher crude protein yield due to application of higher fertilizer level might be due to the higher availability of sources under higher nitrogen levels and higher photosynthetic activities. Similar results were obtained by Ramchandrapa *et al.* (2004).

Yield parameter i.e. cob yield with husk (46.74 q ha⁻¹) and grain yield (34.21 q ha⁻¹) (Table 3) were found to be highest in grain crop at a spacing of 60cm x 30cm (T₁). Grain equivalent yield (39.77 q ha⁻¹) was found to be highest in treatment T₇ which is at par with grain crop at a spacing of 60cm x 30cm (T₁) (39.49 q ha⁻¹). Inter and intra row spacing in this management practice might be favourable for minimizing competition for resource viz., water, nutrients, space and light which result in higher cob yield with husk, weight of husk, stover and grain yield. Grain yield is the main target of crop production. Plant spacing significantly influenced the grain yield of maize. Moriri *et al.* (2010) reported that grain yield increased with increase plant density. These finding are in conformity with Ahmed (2010) and Agasibagil (2006). Significant positive effect of N-P₂O₅-K₂O on cob yield with husk (45.06 q ha⁻¹), grain yield (31.98 q ha⁻¹) and grain equivalent yield (35.67 q ha⁻¹) were observed with increasing levels of fertilizer (Table 3). This might be due to the higher response of maize plants towards higher levels of fertilizer which resulted in higher yield, grain equivalent yield and yield attributing character. Similar results were observed by Hanif (2007) who concluded that increase in yield was mainly due to increase in growth parameters with respect to the increased in levels of nitrogen and phosphorous up to 150-100 kg ha⁻¹. This result was in conformity with Jogdand *et al.* (2008).

The interaction effects of different crop management practices and levels of fertilizer were found to be significant in respect of grain yield of maize (Table 3.a.). Significantly the highest grain yield (36.55q ha⁻¹) was recorded with the grain crop sown at a spacing of 60 cm x 30 cm and fertilized with 90- 60-60 kg N- P₂O₅-K₂O ha⁻¹ (T₁F₂) which remained *at par* with all the crop management practices combined with 50 per cent higher level of NPK fertilizers except fodder cum grain crop sown at 30cm x 30cm spacing with removal of alternate rows at tasseling (T₄F₂) and milking (T₅F₂) stages. The lowest grain yield (16.74q

effect of different crop management practices and levels of fertilizer (Table 3.b.). Significantly the highest grain equivalent yield (43.96q ha⁻¹) was recorded with the fodder cum grain crop at a spacing of 30cm x 15cm

TABLE 3
Effect of crop management practices and levels of fertilizer on yield parameter of dual purpose maize

Treatment	Cob yield (q/ha) with husk	Grain yield (q/ha)	Grain Equivalent yield (q/ha)
Crop management (T)			
T ₁ : Grain (G)	46.74	34.21	39.49
T ₂ : Fodder (FD)	-	-	8.20
T ₃ : F at KHS* with S ₁ +G	38.24	25.76	30.75
T ₄ : F at TS with S ₁ +G	35.62	23.67	30.99
T ₅ : F at MS with S ₁ +G	35.05	23.15	30.71
T ₆ : F at KHS with S ₂ +G	46.33	32.19	38.49
T ₇ : F at TS with S ₂ +G	45.25	31.10	39.77
T ₈ : F at MS with S ₂ +G	44.08	30.62	39.44
S. Em±	3.23	1.33	39.49
C. D. (P=0.05)	9.39	3.86	8.20
Levels of fertilizer (F)			
F ₁ (100% of RDF)	38.16	25.36	28.79
F ₂ (150% of RDF)	45.06	31.98	35.67
S. Em±	1.73	0.71	0.63
C. D. (P=0.05)	5.03	2.07	1.82
Interaction (T × F)			
S. Em±	3.23	1.33	1.26
C. D. (P=0.05)	NS	3.86	3.64

*KHS : Knee-high Stage, TS : Tasseling Stage, MS : Milking Stage, S₁ : 30 cm x 30 cm spacing and S₂ : 30 cm x 15 cm.

TABLE 3A
Interaction effect of crop management practices and levels of fertilizer on grain yield (q/ha) of dual purpose maize

Crop management (T)	Grain yield (q/ha)	
	Levels of fertilizer	
	F ₁ (100% of RDF)	F ₂ (150% of RDF)
T ₁ : Grain (G)	31.86	36.55
T ₂ : Fodder (FD)	-	-
T ₃ : F at KHS* with S ₁ +G	16.74	34.78
T ₄ : F at TS with S ₁ +G	21.62	25.71
T ₅ : F at MS with S ₁ +G	22.88	23.41
T ₆ : F at KHS with S ₂ +G	29.51	34.87
T ₇ : F at TS with S ₂ +G	27.72	34.49
T ₈ : F at MS with S ₂ +G	27.17	34.06
S. Em±	1.33	
C. D. (P=0.05)	3.86	

*KHS : Knee-high Stage, TS : Tasseling Stage, MS : Milking Stage, S₁ : 30 cm x 30 cm spacing and S₂ : 30 cm x 15 cm.

ha⁻¹) was recorded with the fodder cum grain crop sown at a spacing of 30cm x 30 cm and removal of alternate rows at knee-high stage for fodder and supplied with RDF (application of crop management practice (T₃F₁)).

The interaction effect was found to be significant in respect of grain equivalent yield due to

under higher fertilizer level and removal of alternate rows at tasseling stage for fodder ($T_7 F_2$) which was *at par* with the same level of fertilizer in the crop management practice like grain crop grown at a spacing of 60cm x 30cm ($T_1 F_2$), fodder cum grain crop at a spacing of 30 cm x 15cm with removal of alternate rows at milking stage ($T_8 F_2$) and knee-high ($T_6 F_2$) stage for fodder. The lowest grain equivalent yield (7.44 q ha⁻¹) was recorded with the application of crop management practice $T_2 F_1$ (fodder crop at a spacing of 30cm x 15cm at 100 per cent of RDF).

It is well known that productivity of a crop demands mainly on agronomic practices including application of fertilizers and manures. But in reality, only economically feasible practices are accepted by the farmers. Therefore, both the production of a crop and the cost of cultivation are also equally important. The conclusive analysis was made based on cost of production, gross return, net return and B: C ratio of respective treatments. In the present investigation, the perusal data (Table 4) revealed that among the different treatments highest cost of cultivation (Rs. 37,618.43 ha⁻¹) and gross return (Rs. 12,095167 ha⁻¹) were more in fodder cum grain crop at a spacing of 30 cm x 15 cm with removal of alternate rows at tasseling stage for fodder in combination with 150 per cent of RDF fertilizer level ($T_7 F_2$). But net return was found to be highest (Rs 90631.40 ha⁻¹) in grain crop at a spacing of 60 cm x 30 cm in combination with 150% of RDF. Highest B:C ratio (4.46) was also found in this combination of crop management practice and fertilizer level. This could be due to the increase in production of grain yield and green fodder yield along with the

TABLE 3B
Interaction effect of crop management practices and levels of fertilizer on grain equivalent yield (q/ha) of dual purpose maize

Crop management (T)	Grain equivalent yield (q/ha)	
	Levels of fertilizer	
	F ₁ (100% of RDF)	F ₂ (150% of RDF)
T ₁ : Grain (G)	36.94	42.03
T ₂ : Fodder (FD)	7.44	8.97
T ₃ : F at KHS* with S ₁ +G	21.48	40.02
T ₄ : F at TS with S ₁ +G	28.52	33.46
T ₅ : F at MS with S ₁ +G	30.10	31.33
T ₆ : F at KHS with S ₂ +G	35.30	41.69
T ₇ : F at TS with S ₂ +G	35.58	43.96
T ₈ : F at MS with S ₂ +G	34.99	43.88
S. Em±	1.26	
C. D. (P=0.05)	3.64	

*KHS : Knee-high Stage, TS : Tasseling Stage, MS : Milking Stage, S₁ : 30 cm x 30 cm spacing and S₂ : 30 cm x 15 cm.

increase in other growth and yield attributing characters. The highest net return and benefit: cost ratio was realized by Lingaraju *et al.* (2008) in hybrid maize at closer spacing of 60cm x 20cm and application of 200 per cent recommended levels of fertilizer.

CONCLUSION

From the present investigation it can be concluded that among all the crop management practices the sole grain crop (T_1) resulted highest grain yield of 34.21q ha⁻¹ which was closely followed by

TABLE 4
Effect of crop management practices and levels of fertilizer on economics of dual purpose maize

Treatment	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Benefit : Cost ratio
Crop management (T)				
T ₁ : Grain (G)	26214.43	116845.83	90631.40	4.46
T ₂ : Fodder (FD)	36218.43	16403.50	-19814.93	0.45
T ₃ : F at KHS* with S ₁ +G	30950.43	96804.67	65854.24	3.13
T ₄ : F at TS with S ₁ +G	30950.43	95427.17	64476.74	3.08
T ₅ : F at MS with S ₁ +G	30950.43	108973.00	78022.57	3.52
T ₆ : F at KHS with S ₂ +G	37618.43	118000.83	80382.40	3.14
T ₇ : F at TS with S ₂ +G	37618.43	120951.67	83333.24	3.22
T ₈ : F at MS with S ₂ +G	37618.43	118902.67	81284.24	3.16
Levels of fertilizer (F)				
F ₁ (100% of RDF)	32141.34	89049.79	56908.45	2.77
F ₂ (150% of RDF)	34893.52	105543.92	70650.40	3.02

*KHS : Knee-high Stage, TS : Tasseling Stage, MS : Milking Stage, S₁ : 30 cm x 30 cm spacing and S₂ : 30 cm x 15 cm.

TABLE 4B

Effect of crop management practices and levels of fertilizer on economics of dual purpose maize

Treatment	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Benefit : Cost ratio
F ₁ T ₁	24838.34	105458.33	80619.99	4.25
F ₁ T ₂	34842.34	14873.67	-19968.67	0.43
F ₁ T ₃	29574.34	92297.00	62722.66	3.12
F ₁ T ₄	29574.34	87453.67	57879.33	2.96
F ₁ T ₅	29574.34	79763.33	50188.99	2.70
F ₁ T ₆	36242.34	107632.33	71389.99	2.97
F ₁ T ₇	36242.34	115358.33	79115.99	3.18
F ₁ T ₈	36242.34	109561.67	73319.33	3.02
F ₂ T ₁	27590.52	128233.33	100642.81	4.65
F ₂ T ₂	37594.52	17933.33	-19661.19	0.48
F ₂ T ₃	32326.52	101312.33	68985.81	3.13
F ₂ T ₄	32326.52	103400.67	71074.15	3.20
F ₂ T ₅	32326.52	110313.67	77987.15	3.41
F ₂ T ₆	38994.52	128369.33	89374.81	3.29
F ₂ T ₇	38994.52	126545.00	87550.48	3.25
F ₂ T ₈	38994.52	128243.67	89249.15	3.29

fodder cum grain crop grown at a spacing of 30cm × 15cm with subsequent removal of alternate rows at knee-high (T₆), tasseling (T₇) and milking (T₈) stages for fodder with a decrease of 5.90, 9.09 and 10.49 per cent in grain yield and supplying fodder yield @ 13.27, 47.74, and 53.13 per cent of pure fodder crop, respectively. The highest Benefit:Cost ratio of 4.46 was, however, found in grain crop sown at a spacing of 60cm × 30cm (T₁) and was almost equal (3.22) to the high density (30cm × 15cm) fodder cum grain crop followed by removal of alternate rows at tasseling stage for fodder (T₇). The highest Benefit: Cost ratio (3.02) in terms of levels of fertilizer was found in 150 per cent of recommended dose of fertilizers. This study has shown that with proper seeding densities and thinning regime production of both fodder and grain is possible.

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