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Effect of time of sowing and nitrogen levels on yield attributes, yield and quality parameters of *Rabi* forage maize (*Zea mays* L.)

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Abstract
An experiment was carried out at the Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of 2014-15 to find out the optimum time of sowing and nitrogen levels for *rabi* forage maize crop. Green and dry weight per plant were significantly higher by sowing the *rabi* forage maize crop on 1st week of October and it was followed by 3rd week of October sowing at 30 and 60 DAS. Green and dry forage yield did not differ significantly by different sowing times. Significantly higher green forage productivity per day was recorded by the 1st week of October sowing. Crude protein content, crude fibre content, nitrogen content and nitrogen uptake by *rabi* forage maize crop did not differ significantly due to different time of sowing. Green weight per plant, dry weight per plant, green forage yield, dry forage yield and green forage productivity per day were significantly higher by the application of 120 kg nitrogen per hectare and it was followed by the application of 100 kg nitrogen per hectare at 30 and 60 DAS and also at harvesting time. Maximum net realization and benefit: cost ratio was recorded by 1st week of October sowing fertilizing with the 120 kg nitrogen per hectare and was followed by 100 kg nitrogen per hectare.

Keywords: Green weight and dry weight per plant green and dry forage yield, green forage productivity per day

Introduction
Livestock population is the largest in the India and is the backbone of Indian economy next to agriculture. Among the different livestock populations, cattle and buffalo which account more than two third of Indian livestock plays an important role in milk production. The productivity of animals in India, especially milch animals is very low as compared to developed counties primary due to less availability of nutritive feed and fodder to animals (Patel *et al.* 2011) [6]. The estimated amount of fodder in the country is 1650 million tonnes annually but in contrast of these requirements, 48 million tonnes of concentrates, 395 million tonnes of green fodder and 451 million tonnes of dry fodder are available, which contribute about 62.8 percent and 23.5 percent deficit of green and dry forage production, respectively (Kumar and Faruqui, 2010) [5]. The real scenario is different in Gujarat state, where total animal population is about 18.84 million heads and their optimum fodder requirement worked out is 42.2 million tonnes, whereas only 20.0 million tonnes of fodder is made to available in normal year (Anonymous, 2009-10). In the arid and semi arid region of Gujarat, farmers experience a long lean period of winter from November to December when no green fodder is available to the livestock resulting in the drastic reduction in the milk productions. The only available fodder for the livestock in the winter is pearlmillet straw. The green fodder availability in the lean period can improve the productivity of farm animals. So that there is urgent need to develop agronomic practices for availability of green fodder in the north Gujarat during November to December month. Maize (*Zea mays* L.) is one the most important cereal forage crop having quick growing nature, palatable nutritious quality, high yield and wider adaptability over a range of environmental conditions. Maize is used as green fodder, straw, hay or silage. It can be safely fed at any stage of crop growth. In addition to this, maize is a C_4 in nature and can thus thrive well even at high temperature. High yielding varieties of maize are most sensitive to time of sowing; hence optimum time of sowing contributes more towards green forage yield. Moreover nitrogen application increases the crude protein and metabolizes energy besides improving succulence and palatability of fodder crops.

The information of time of sowing and nitrogen levels is lacking so that an experiment was planned at Agronomy Instructional Farm, S.D.A.U., Gujarat.

Materials and method

An experiment on effect of time of sowing and nitrogen levels on growth and forage yield of *rabi* forage maize (*Zea mays* L.) was carried out at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar during *rabi* season of 2014-15. The soil of experimental field was loamy sand in texture with low in organic carbon (0.16 %) and available nitrogen (144 kg/ha), medium in available phosphorus (31 kg/ha) and high in potash (282 kg/ha) having pH value of 7.5. Total 12 treatment combinations comprising four level of time of sowing in main plot viz., 1st week of October (D_1), 3rd week of October (D_2), 1st week of November (D_3) and 3rd week of November (D_4) and three nitrogen levels in sub-plot viz., 80 kg N/ha (N_1), 100 kg N/ha (N_2) and 120 kg N/ha (N_3) laid out in split plot design with four replications. Half dose of nitrogen and full dose of phosphorus were applied to each plot as per treatment through urea and diammonium phosphate. Remaining dose of nitrogen was applied in two equal split coincide with irrigation. The crop was kept weed free during the whole crop period and irrigation was applied at an interval of 10-12 days during the crop season. The growth parameters observations were recorded from the ring line of the each treatment plot. Five random plants from each plot from the ring line excluding the border rows were selected for taking the observations on plant height, green and dry weight per plant. The fresh forage yield from the net plot leaving border rows and penultimate rows was recorded immediately after harvesting the maize crop which was then sun- dried in the same plot till the constant weight was recorded for dry fodder yield. The economics was calculated on the basis of prevailing market prices of inputs and produce.

Results and discussion

Yield parametrs

The plant height, green weight per plant and dry matter accumulation per plant were influence significantly by different sowing time. The plant sown on first week of October achieves significantly highest plant height, green weight per plant and dry matter accumulation per plant than that of late sown crop. This might be attributed to the maximum length of growing period available to the first week of October sown crop in comparison to the third week of November sown crop. Cell division and cell expansion are more sensitive to the temperature than is photosynthesis. More ever, this might be due to longer and favourable period for growth and development resulting in more leaf length, leaf width and taller plant. Among the levels of nitrogen, 120 kg nitrogen gave the highest plant height, green weight per plant and dry matter accumulation per plant and was closely followed by 100 kg nitrogen per hectare and both were significantly higher than 80 kg nitrogen per hectare at 30, 60 DAS and at harvesting time also. The differences in yield parameters viz; green weight per plant and dry matter accumulation might be due to difference in supply of available nutrients. Since the plant was healthy under treatment having higher nitrogen application, they produce more dry matter which was then reflected in their yield parameters. Aslam *et al.* 2011 [2] reported that application of 150 kg nitrogen gave higher plant height, fresh weight and dry weight per plant.

Forage yield

Sowing time influenced the green and dry forage yield which remains more or less equal during all the sowing time i.e. crop sown on first week of October to third week of November but significantly higher green forage productivity per day was recorded by the 1st week of October sowing (Table 1). Sowing of third week of November however caused numerically marked reduction in fodder yield. Numerically highest fodder yield 368 and dry fodder yield 75 quintal per hectare were recorded in first week of October sowing followed by third week of October and first and third week of November sowing. A decrease in green and dry fodder yield was recorded with successive delay in sowing time. Lower fodder yield in late sown forage maize could be due to less production of forage owing to lower temperature at early growth stage in late sown crop as compared to early sown crop. The increase in green and dry fodder yield was 8 and 14 percent under first October sowing over third week of November sowing. Significantly higher green forage productivity per day was recorded by the 1st week of October sowing. Dar *et al.* 2014 [3] also reported higher forage yield in early sowing of October as compared to late sowing which they attributed to available congenial temperature for better growth and development of forage maize.

Green forage yield, dry forage yield and green forage productivity per day should significantly and consistently increase with increase in nitrogen levels from lower to higher (Table 1). Application of 120 kg nitrogen being at par with 100 kg nitrogen showed significantly higher green and dry forage yield and green forage productivity per day of *rabi* forage maize. The better development of almost all growth and yield parameters with this treatment might have favoured increase in green and dry fodder yield. The increase in green and dry fodder yield was to the magnitude of 22 and 15 per cent over 80 kg nitrogen per hectare. This might be attributed to continuous and more supply of nitrogen which might have met the nitrogen requirement of crop at all growth stages enables the plants to assimilate sufficient photosynthetic product and then improve the dry matter accumulation.

Nutrient uptale

The nutrient uptake by plant (Table 2) decreased numerically in delay sowing. The highest nitrogen uptake by fodder maize plant (66 kg per plant) was reported in the crop sown in first October. The uptake of nutrients by crop is mainly a function of yield of plant materials and efficient development of root systems. With delay in sowing the growth and yield of crop reduced resulting in the low uptake of nitrogen. The levels of nutrient uptake significantly increased with each successive increase in nitrogen levels in soil. The higher uptake of nitrogen was observes with 120 kg nitrogen as compared with 80 kg nitrogen per hectare. Thus amount of added nitrogen to the crop and its content in the post harvest soil affect the uptake of nutrients by plant.

Quality parametrs

Among the sowing time, third week of November sowing registered numerically higher crude protein and fibre content and lower crude protein and fibre content was recorded by first week of October sowing. Since the protein content is inversely proportional to the green fodder yield and is the genetically character of the plant remained non significant among all sowing time. Increase in nitrogen levels significantly improves protein and fibre content. Fertilizing the *rabi* forage maize crop with 120 kg nitrogen registered

significant improvement in the crude protein and fibre content over lower nitrogen levels. This might be due to that nitrogen being an essential constituent of chlorophyll, protoplasm and nucleic acid and also more synthesis of fibre by plant tissue resulting in the vigorous and luxuriant vegetative growth of *rabi* fodder maize crop. This result are confirming with those of Aslam *et al*. 2011 [2]. The reported that the application of 150 kg nitrogen per hectare contributed to the highest protein content of fodder maize crop.

Economics

Net realization and benefit: cost ration were higher with the crop sown on first week of October followed by crop sown on third week of October, first and third week of November (Table 2). The lowest net realization and benefit: cost ratio was recorded by the third week of November sown crop. Application of 120 kg nitrogen ranked the highest net realization and benefit: cost ratio over rest of the nitrogen levels.

Thus under north Gujarat agroclimatic conditions higher green and dry fodder yield and profitability of forage maize could be achieved by sowing the maize crop (African tall) on 1st week of October to 3rd week of November and fertilizing with 120 kg nitrogen per hectare followed by 100 kg nitrogen per hectare.

Table 1: Plant height, green weight per plant, dry weight per plant, green forage yield, dry forage yield and green forage productivity per day of *rabi* forage maize crop as influenced by time of sowing and nitrogen levels

Treatments	Plant height (cm)			Green weight per plant (g)			Dry weight per plant (g)			Green forage yield (q/ha)	Dry forage yield (q/ ha)	Green forage productivity per day (q/ha/d)
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest			
Main plot : Time of sowing (D)												
D_1 : 1st week of October	63.90	138.04	173.56	20.90	150.14	200.04	5.73	36.81	51.99	368	75	5.04
D_2 : 3rd week of October	60.37	130.38	166.05	17.06	139.38	192.14	3.11	31.91	50.19	352	73	4.57
D_3 : 1st week of November	42.90	99.43	160.33	12.48	120.44	186.57	2.65	27.48	49.80	346	71	4.32
D_4 : 3rd week of November	31.93	89.33	155.45	7.46	113.98	178.66	1.67	26.79	47.65	342	66	3.53
S.Em.±	1.36	2.98	4.26	0.57	3.30	4.95	0.14	1.02	1.40	13.4	2.4	0.16
C.D. at 5 %	4.36	9.52	NS	1.81	10.56	NS	0.45	3.25	NS	NS	NS	0.51
C. V. (%)	9.49	9.02	9.01	13.52	8.73	9.06	14.74	11.45	9.72	13.24	11.65	12.60
Sub plot : Nitrogen levels (kg/ha) (N)												
N_1 : 80	47.04	106.71	149.82	12.42	113.41	177.46	2.93	25.75	41.59	310	66	3.84
N_2 : 100	51.05	114.28	164.88	14.36	136.12	189.68	3.12	32.18	50.86	366	72	4.54
N_3 : 120	51.24	121.91	176.84	16.65	143.43	200.91	3.84	34.31	57.27	379	76	4.71
S.Em.±	0.98	1.55	2.08	0.33	2.37	3.22	0.07	0.77	0.96	9.5	1.6	0.12
C.D. at 5 %	2.86	4.51	6.06	0.96	6.92	9.41	0.19	2.26	2.81	27.81	4.71	0.35
D X N (Interaction)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	7.87	5.41	5.07	9.12	7.24	6.81	7.97	10.06	7.72	10.83	9.04	10.90

Table 2: Crude protein content, crude fibre content, nitrogen content and nitrogen uptake of *rabi* forage maize crop as influenced by time of sowing and nitrogen levels

Treatments	Crude protein content (%)	Crude fibre content (%)	Nitrogen content (%)	Nitrogen uptake (kg/ha)	Available N in the soil (kg/ha)	Available P_2O_5 in the soil (kg/ha)
Main plot : Time of sowing (D)						
D_1 : 1st week of October	5.40	33.55	0.86	66	166	30
D_2 : 3rd week of October	5.54	34.12	0.89	64	163	29
D_3 : 1st week of November	5.50	34.88	0.88	62	159	29
D_4 : 3rd week of November	5.58	35.83	0.89	59	156	28
S.Em.±	0.09	0.54	0.01	2.1	2.4	0.6
C.D. at 5 %	NS	NS	NS	NS	NS	NS
C. V. (%)	5.35	5.41	5.39	11.80	5.18	7.18
Sub plot : Nitrogen levels (kg/ha) (N)						
N_1 : 80	5.37	33.93	0.86	56	157	29
N_2 : 100	5.51	34.65	0.88	64	162	29
N_3 : 120	5.65	35.20	0.90	68	164	30
S.Em.±	0.06	0.31	0.01	1.7	1.4	0.3
C.D. at 5 %	0.16	0.91	0.03	5.10	4.14	NS
D X N (Interaction)	NS	NS	NS	NS	NS	NS
C. V. (%)	4.06	3.61	4.06	11.10	3.53	4.87

Table 3: Economics of the different treatments on *rabi* forage maize crop as influenced by time of sowing and nitrogen levels

Treatments	Green forage yield (q/ha)	Gross realization (/ha)	Cost of production (/ha)	Net realization (/ha)	Benefit: Cost ratio
Main plot: Time of Sowing (D)					
D_1 : 1st week of October	368	91,985	32,715	59,270	2.81
D_2 : 3rd week of October	352	87,957	32,715	55,242	2.69
D_3: 1st week of November	346	86,418	32,715	53,703	2.64
D_4 : 3rd week of November	342	85,530	32,715	52,814	2.61
Sub plot: Nitrogen levels (kg/ha) (N)					
N_1 : 80	310	77,469	32,441	45,028	2.39
N_2 : 100	366	91,536	32,714	58,822	2.80
N_3 : 120	379	94,912	32,991	61,921	2.88

References

1. Annual report. Districtwise area and production, Directorate of Horticulture, Gujarat state, Ahmedabad, 2009-2010.
2. Aslam M, Iqbal A, Zamir MSI, Mubeen M, Amin M. Effect of different nitrogen levels and seed rates on yield and quality of maize fodder. Crop & Environment, 2011; 2(2):47-51.
3. Dar NA, Singh KN, Ahmad L, Sofi JA, Bhat EM, Kotru R. Influence of dates of sowing, cultivars and different fertility levels on fodder oat (*Avena sativa* L.) under temperate conditions of Kashmir valley (India). Range Management and Agroforestry. 2014; 35(1):51-55.
4. Khan A, Munsif F, Akhtar K, Afridi MZ, Zahoor Ahmad Z, Fahad S *et al*. Response of fodder maize to various levels of nitrogen and phosphorus. American Journal of Plant Sciences. 2014; 5(15):2323-2329.
5. Kumar S, Faruqui SA. Forage production technologies for different agro-ecological regions, 2010, 1.
6. Patel TU, Arvadia MK, Malik PK, Patel DD, Patel PS. Production of oat (Avena sativa) under different cutting management and split application of nitrogen. Indian Journal of Agronomy. 2011; 56(2):164-67.