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Response of Different Dates of Sowing and Fertility Levels on Yield and Economics of *Rabi* Maize (*Zea mays* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A discipline test changed into performed for the duration of the *rabi* season of 2015-16 to study the performance of *rabi* maize to one-of-a-kind dates of sowing and fertility tiers. The trial become laid out in a split plot design with 4 replications, assigning a total 48 mixtures *i.e.* four sowing dates (15th October, 1st November, 15th November and 1st December) in the predominant plot and three fertility ranges from urea and DAP (200-100-00, 175-87.5-00 and 150-75-00 kg NPK in kg ha^{-1}.) in the sub plots. The crop sown on 1st November extensively more advantageous the yields and economics compared to early sowing 15th October and past due sowing 15th November and 1st December whilst, 200-100-00 kg NPK in line with ha^{-1} utility appreciably improved over one 175-87.5-00 kg NPK in step with ha and 150-75-00 kg NPK in line with ha.

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1. INTRODUCTION

"Some of the cereals, maize (*Zea mays* L.) ranks 0.33 in total global meals manufacturing after wheat and rice and it's far the staple meals in many nations, in particular within the tropics and sub-tropics" [1]. Maize is taken into consideration as the "Queen of Cereals". Being a C4 plant, it's far capable to utilize sun radiation extra efficiently, even at higher radiation intensity.

"The maximum popular variety of quality protein maize (HQPM-1) with gradual preliminary growth and there after energetic increase, It has excessive nitrogen necessities as compared to different hybrids" [1].

"Augment a better crop yield according to unit area, right sowing time and inter row spacing are the maximum essential elements. The proper sowing time exerts a marked impact at the increase and sooner or later the yield of a crop. Sowing the crop at right time ensures better plant increase and additionally inhibits weed increase. There are evidences that most beneficial time of showing is one of the numerous cultural manipulations and performs a crucial role in boosting up the yield, in particular in India sub continent where the optimum time of sowing varies to outstanding extent because of extensively varying agro-climate conditions. Though, the most efficient time of sowing is decided via several factors, fluctuations in temperature at some point of the growing season play a essential role" [2-4].

"The various primary vitamins, nitrogen even though an expensive input could be very crucial as it's far intimately involved in the method of photosynthesis and directly pondered within the general dry count production. It's also associated with full of life vegetative boom, deep inexperienced coloration and yield. An ok deliver of nitrogen is carefully related to the growth and development of plant life. Nitrogen is the most crucial input for understanding protein yield of any crop as requirement of nitrogen is the highest among all the critical plant vitamins and this nutrient is most restricting underneath Indian conditions. It plays an essential role in plant metabolism via distinctive feature of being an essential structural factor of the cellular and containing lots numerous forms of metabolically lively compounds. It's also a constituent of chlorophyll, which is critical for the harvest of sun electricity. Nitrogenous fertilizer consequently, forms a basic enter for acquiring excessive yield. Nitrogen being an crucial part of protoplasm and an crucial constituent of plant tissues, its regular application fast indicates beneficial effect with the aid of growing leaf greenness plant improvement. Maize is an exhaustive crop calls for a regulated and assured deliver of vitamins mainly nitrogen at some stage in its growing period proper from seedling level to grain filling degree. The demand of plant life for nitrogen is more than another nutrient and it's miles noticed that it is deficiency at any degree of increase, specially at tasseling and silking stage, can also result in small, shrunk grains and virtual crop failure. Nitrogen deficiency is characterized through stunted and spindly plant increase with yellowing of inexperienced foliage specially the decrease leaves. Hence better yield of excellent protein of maize can be received through sensible use of nitrogen that may along make a contribution 45-60 % crop yield" [5].

Phosphorus is a charming plant nutrient. Its miles concerned in a huge variety of plant strategies from allowing mobile division to the development of an excellent root device and for making sure timely and uniform ripening of the crop. It is most wished by means of young speedy growing tissues and performs a numbers of features related to boom, development, photosynthesis and the usage of carbohydrates. In maize crop, phosphorus helps in development of all phases. It indicates its deficiency especially on the seedling level, even though its miles wished most after flowering level.

2. MATERIALS AND METHODS

The experiment was conducted at the Cotton Research Farm, Sardarkrushinagar Dantiwada Agricultural University, Khedbrahma, Dist.-Sabarkantha, Gujarat. In India during the *rabi* season of 2015-16. The soil of experimental field was loamy sand soil in reaction (pH 7.4) which was low in organic carbon content (0.31 %) and Available nitrogen (178.50 kg ha^{-1}), and medium in available phosphorus (30.70 kg/ha) and available potash (262.01 kg ha^{-1}). The trial was laid out in Split Plot Design (SPD) with four replications assigning 48 treatment combinations of four sowing dates (15^{th} Oct., 1^{st} Nov., 15^{th} Nov. and 1^{st} Dec.) in main plots and three fertility levels through urea and DAP (200-100-00, 175-87.5-00 and 150-75-00 kg NPK per ha^{-1}) in sub

plot. The hybrid HQPM-1 variety of maize was sown according to the dates decided in the treatment, maintaining 75 cm row-to-row and 20 cm plant-to-plant distance with the seed rate of 20 kg ha^{-1} at 2.5 cm depth. Full dose of phosphorus and half of dose of nitrogen as consistent with remedy via diammonium phosphate and urea, respectively, were carried out as basal and final half of dose of nitrogen became top dressed in two same splits–one every at 4 leaf stage and at flowering level. Other obligatory activities viz. Interculture and plant safety measures had been implemented as want based.

3. RESULTS AND DISCUSSION

3.1 Effect of dates of sowing

Significantly better grain yield was produced via sowing the rabi maize crop on 1st November (Table1) compared to different treatments, but it become determined at par with 15th October sowing. The percentage boom in grain yield through 1st November sowing became to the song of 6.Fifty three, eleven.Sixty six and 24.36 over 1st October, 15th November and 1st December sowing. The crop sown on 1st November gave 1004 kg higher grain yield than 1st December sowing. This is probably due to most suitable boom duration favoured by [means of 1st November sowing. The most yields recorded below 1st November sowing might be because of favourable temperature resulting in higher boom and improvement of the crop which accelerated yield attributes *viz;* range of grains per cob, grain weight according to cob and seed index, which caused better grain production performance via the crop. These findings are in near agreement with the results pronounced by means of Sawhney et al., (1989), Nandal and Agarwal [6], Rahman et al. [7], Rahman et al. [8], Reddy et al. [9], Singh et al., [10] and Shaheenuzzamn et al. [11].

A notably better straw yield become produced through sowing the *rabi* maize crop on 1st November (Table 1) as compared to other sowing dates. But, it remained at par with 15th October sowing. The elevated in straw yield of rabi maize below 1st November and 15th October sowing changed into to the track of 9.02, 20.45 and 3.06, 14.05 percentage over fifteenth November and 1st December sowing respectively. Better straw yield received underneath those treatments is probably due to environmental factors like temperature, solar radiation and day light progressively faded throughout October to December and favoured the boom of early sown crop than that of late sown crop, as obvious from multiplied value of increase attributes *viz;* plant top and basal girth. The results are in near location to the findings of Bainade et al. [12], Porwal and Jain [13], Singh et al., [10] and Shaheenuzzamn et al. [11].

As a long way as harvest index is involved, diverse treatments of sowing date failed to express their widespread effect; but, numerically the most fee of harvest index (48.78 %) turned into observed beneath 1st November sowing. The consequences are in consonance with the ones of Porwal and Jain [13]. Substantially higher protein yield turned into cited under remedy D2 (1st November). However, it was discovered at par with sowing of *rabi* maize on 15th October and fifteenth November. The protein yield increased below 1st November, 15th October and 15th November to value of 26.Ninety two, 18.02 and 12.25 percent over 1st December sowing. This might be because of higher price of protein content and grain yield via 1st November, fifteenth October and 15th November sowing (Table 1). The effects are in closely accordance with the findings of Verma et al., [14].

Economics is the forecast attention of the farmer's point of view whilst questioning a selection to adopt a new generation. The information in Table 2 indicated that the very best net returns of ₹73371 ha^{-1} changed into done beneath 1st November sowing, followed by means of 15th October sowing ₹66302 ha^{-1}. Each those remedies additionally recorded higher BCR (1.96 and 1.77) value over different remedies. The minimal net returns of ₹52024/ha and BCR of 1.39 were located by means of 1st December sowing. This could be attributes to higher grain and straw yield recorded underneath early sown crop than late sown crop with none additional expenditure (Table 2). These findings are substantiated with the ones stated via Patel et al., [15], Porwal and Jain [13] and Singh et al. [10].

3.2 Effect of Fertility Levels

The grain yield of *rabi* maize became significantly prompted due to unique fertility stages. Application of 200-100-00 kg NPK ha^{-1} (F_3) recorded substantially the highest grain yield of *rabi* maize. The lower fertility level of treatment F_1 (150-75-00 kg NPK ha^{-1}) recorded the minimal grain yield of *rabi* maize. The treatment F_1 (150-

Table 1. Yields of *rabi* maize as influenced by date of sowing and fertility levels

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)	Protein content (%)	Protein yield (kg ha^{-1})
Main plot : Date of sowing (D)					
D_1 : 15th October	4790	5080	48.5	10.2	491
D_2 : 1st November	5125	5365	48.8	10.3	528
D_3 : 15th November	4590	4929	48.1	10.2	467
D_4 : 1st December	4121	4454	47.9	10.1	416
S.Em.±	162.64	130.32	1.31	0.30	19.79
C.D. at 5 %	520.32	416.93	NS	NS	63.32
C. V. (%)	12.10	9.11	9.38	10.29	14.42
Sub plot : Fertility levels (NPK kg/ha) (F)					
F_1 : 150-75-00 kg/ha	4249	4700	47.4	10.0	422
F_2 : 175-87.5-00 kg/ha	4540	4817	48.4	10.1	461
F_3 : 200-100-00 kg/ha	5280	5355	49.1	10.5	544
S.Em.±	129.20	91.10	0.95	0.15	13.01
C.D. at 5 %	377.10	265.91	NS	0.45	37.98
D x N (Interaction)	NS	NS	NS	NS	NS
C. V. (%)	11.10	7.35	7.88	6.03	10.95

Table 2. Economics of *rabi* maize as influenced by date of sowing and fertility levels

Treatment	Yield (kg/ha)		Gross return (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net realization (₹ ha^{-1})	BCR (%)
	Grain	Straw				
Main plot: Date of sowing (D)						
D_1 : 15th October	4790	5080	103718	37416	66302	1.77
D_2 : 1st November	5125	5365	110787	37416	73371	1.96
D_3 : 15th November	4590	4929	99533	37416	62117	1.66
D_4 : 1st December	4121	4454	89440	37416	52024	1.39
Sub plot : Fertility levels (NPK kg/ha) (F)						
F_1 : 150-75-00 kg/ha	4249	4700	92481	36467	56014	1.54
F_2 : 175-87.5-00 kg/ha	4540	4817	98303	37416	60887	1.63
F_3 : 200-100-00 kg/ha	5180	5355	111808	38365	73443	1.91

75-00 kg NPK ha^{-1}) and F_2 (175-87.5-00 kg NPK ha^{-1}) have been discovered similarly effective with appreciate to grain yield. The boom in grain yield of *rabi* maize respectively over remedies F_1 (150-75-00 kg NPK ha^{-1}) and F_2 (175-87.5-00 kg NPK ha^{-1}).

The straw yield of *rabi* maize changed into substantially influenced due to one of a kind fertility degrees. Software of 200-100-00 kg NPK ha^{-1} (F_3) recorded notably the best straw yield of *rabi* maize. The boom in straw yield of *rabi* maize under treatment F_3 (200-100-00 kg NPK ha^{-1}) was to the tune of 13.93 and 11.16 percentage, respectively over treatment F_1 (150-75-00 kg NPK ha^{-1}) and F_2 (175-87.5-00 kg NPK ha^{-1}). The increase in grain and straw yield beneath better fertility degree might be because of reality that better degrees of nitrogen and phosphorus brought about good enough deliver of nutrients to the plant resulting in better increase and yield attributes (Table 1) which in flip led to better physiological technique and the movement of photosynthates to sink which in the long run ended in better economic yield. The effects are in close proximity with the findings of Subbian et al., [16], Mishra et al. [17], Tyagi et al. [18], Singh et al. [19], Tank et al. [20], Sepat and kumar [21], Paramasivam et al. [22] and Meena et al. [23] and Mathuliya et al. [24].

From the prevailing examine, it is able to be resulted that exceptional fertility degrees had vast impact on protein content and protein yield of *rabi* maize (Table 1). Substantially higher protein content material and protein yield were recorded beneath treatment F_3 (200-100-00 kg NPK ha^{-1}) as compared to different remedies. However, it was located at par with remedy F_2 (175-87.5-00 kg NPK ha^{-1}). The protein yield multiplied under F_3 (200-100-00 kg NPK ha^{-1}) and F_2 (175-87.5-00 kg NPK ha^{-1}) remedy to the significance of 28.86 and 9.32 percent over treatment F_1 (150-75-00 kg NPK ha^{-1}). The better protein content acquired via better fertility levels might be due to greatest and ordinary supply of nitrogen nutrient to *rabi* maize crop for growing boom and reproductive phase from soil and as it's miles vital part of protein the building blocks of plant. The better protein yield recorded beneath better fertility level F_3 (200-100-00 kg NPK ha^{-1}) is probably due to higher protein content and grain yield of *rabi* maize (Table 1) because of better growth and yield parameter because of better availability of vitamins to the crop all through the crop length. These findings are closely related to the ones mentioned via Tank et al. [20], Arya and Singh [25], Patel et al. [26] and Washnik et al. [27].

A treatment of 200-100-00 kg NPK according to hectare recorded the maximum net realization of ₹73443 ha^{-1}, and BCR of 1.91, it turned into accompanied with the aid of treatment F_2 (175-87.5-00 kg NPK in keeping with hectare) having internet consciousness of ₹60887/ha and BCR of 1.63 (Table 2). The lowest net returns (₹350014 ha^{-1}) and BCR value (1.54) were recorded by means of remedy F_1 (150-75-00 kg NPK ha^{-1}). This may be attributed because of the highest grain and straw yield recorded with the software of two hundred-100-00 kg NPK in step with hectare. These findings are in close conformity with the ones stated by sarma et al. [28], Patel et al. [29], Sepat and Kumar [30], Lakshami et al. [31], Wasnik et al. [27] and Mathukiya et al. [24].

4. CONCLUSION

On the basis of one year experimentation, it is concluded that the maximum grain yield, protein yield, net returns and BCR can be carried out by sowing of *rabi* maize crop (HQPM-1) on 15th October to 1st November and fertilizing with 200-100-00 kg NPK per hectare.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

5. REFERENCES

1. Singh D. Impact of scheduling on nitrogen on productivity of single cross maize (*Zea mays* L.) hybrids. Indian Journal of Agricultural Sciences. 2010;80(7):649-651.
2. Anonymous. Area and production of maize in India. Directorate of Economics and Statistics, Govt. of India; 2014-15.
3. Shivay YS, Singh RP. Growth, yield and nitrogen uptake of maize (*Zea mays L.*) as influence by cropping system and nitrogen levels. Annals of Agricultural Research. 2000;21(4):494-498.
4. Damor N, Patel GN, Patel CK, Vagela S. Response of Rabi maize (Zea mays L.) to different dates of sowing and fertility levels. Int J Sc. Environ Tech2017. 2017;6(3): 1905-11.
5. Das A, Patel DP, Monda GC, Ghosh PK. Effect of organic and inorganic sources of

nutrients on yield, nutrients uptake and soil fertility of maize (*Zea mays* L.) – mustard (*Brassica juncia*) cropping system. Indian Journal of Agricultural Sciences 2010; 80(1):85-88

6. Nandal DPS, Agarwal SK. Response of winter maize to sowing dates, irrigation and nitrogen. Indian Journal of Agronomy 1991;36(2):239-242
7. Rahman AAM, Magboul EL. Nour AE. Effect of sowing date and cultivar on the yield and yield components of maize in Northern Sudan. Seventh Eastern and Southern Africa Regional Maize Conference 11th to 15th February. 2001; 295-298.
8. Rahman AAM, Eltahir SA, Hamada AA, Siraj OM. Optimum sowing time for maize (*Zea mays*) in Northern Sudan. Sudan J. Agric. Res. 2008;12:1-10.
9. Reddy MM, Padmaja B, Vishnu vardhanreddy M. Performance of maize and sunflower under different sowing dates in rice fallows. J. Res. Angrau 2010;38(1&2): 62-69.
10. Singh Ganesh, Kumar Satish, Singh Rajesh, Singh SS. Growth and yield of Baby corn (*Zea mays* L.) as influenced by varieties, spacings and dates of sowing. Indian j. Agric. Res. 2015;49(4):253-257.
11. Shaheenuzzamn M, Saha RR, Ahmed B, Rahman J, Salim M. Green cob and fodder yield of sweet corn as influenced by sowing time in the hilly region. Bangladesh J. Agril. Res. 2015;40(1):61-69.
12. Bainade SS, Raikhelkar SV, Shinde VS, Arthamwar DN. Effect of sowing dates on growth yield of forage maize in *rabi* season. J. Maharashtra Agric. Univ. 1987; 12(2):180-181.
13. Porwal MK, Jain HK. Effect of sowing dates on winter maize (*Zea mays*) varieties in command area of southern Rajasthan. Indian Journal of Agronomy. 1999;44(3): 560-563.
14. Verma NK, Panday UP, Lodhi MD. Effect of sowing dates in relation to integrated nitrogen management on growth, yield and quality of *rabi* maize. J. of plant and animal sci. 2012;22(2):324-329
15. Patel GJ, Patel GN, Arha MD. Effect of sowing dates on different varieties of *rabi* maize. GAU, Res. J. 1994;20(1):134-136.
16. Subbian P, Thangamuthu GS, Palaniappam SP. Long term response of winter maize to nitrogen, phosphorus and potassium. Indian Journal of Agronomy. 1991;36(4):511-512.
17. Misra BN , Yadav RS, Rajput AL, Pandey, SM. Effect of plant geometry and nitrogen application on yield and quality of winter maize (*Zea mays L.*). Indian Journal of Agronomy. 1994;39(2): 239-242.
18. Tyagi RC, Singh D, Hooda lH. Effect of plant population, irrigation and nitrogen on yield and its attributes of spring maize (*Zea mays L.*). Indian Journal of Agronomy. 1998;43(4):672-676.
19. Singh A, Vyas AK, Singh AK. Effect of nitrogen and zinc application on growth, yield and net returns of maize (*Zea mays L.*). Annals of Agricultural Research. 2000; 21(2): 296-297.
20. Tank DA, Patel SK, Usadadia. Nitrogen management in *rabi* maize (*Zea mays L.*). Crop Research. 2006;31(2):323-324.
21. Sepat S, Kumar A. Nitrogen management in maize (*Zea mays L.*) under life saving and assured irrigations. Indian Journal of Agricultural Science. 2007a;77(7):451-554.
22. Paramasivam M, Kumaresan KR, Malarvizhi P. Effect balanced nutrition on yield, nutrient uptake and soil fertility of maize in vertisol of Tamil Nadu. Indian Journal of Agronomy. 2011;56(2):133-137.
23. Meena KN, Kumar A, Rana DS, Meena MC. Productivity and nutrient uptake of maize (*Zea mays L.*) - wheat (Triticum aestivum) cropping system under different bio-sources and nitrogen levels. Indian Journal of Agronomy. 2011;56(3): 182-188.
24. Mathukia RK, Choudhary RP, Shivran, Ashish, Bhosale, Nilima. Response of *rabi* sweet corn to plant geometry and fertilizer. Current Biotica 2014;7(4):294-298.
25. Arya KC, Singh SN. Productivity of maize (Zea mays L.) as influenced by different levels of phosphorus, zinc and irrigation. Indian Journal of Agricultural Sciences. 2001;71:57-59.
26. Patel KH, Patel JR, Patel JB. Response of *rabi* maize (*Zea mays L.*) to nitrogen and zinc level under middle Gujarat conditions. GAU Research Journal. 2009;34(2):109-111.
27. Wasnik V, Reddy APK, Kasbe SS. Performance of winter maize under different rates of nitrogen and plant population in Telangana region. Crop Research. 2012;44(3): 269-273.
28. Sarma NN, Paul SR, Sarma D. Response of maize to nitrogen and phosphorus under rainfed condition of the hills zone of

Assam. Indian Journal of Agronomy. 2000;45(1):128-131.

29. Patel GJ, Patel GN, Goyal SN, Patel BG. Effect of phosphorus on the growth and yield of hybrid maize. GAU Research Journal. 2000;26(1): 59-60.
30. Sepat, S, Kumar A. Influence of irrigation and nitrogen management on yield and economic of maize (*Zea mays L*.). Crop Research. 2007_b ;33(1-3): 50-52.
31. Lakshmi KV, Balasubramanian A, Sankaran N. Supplemental irrigation, green manuring and nitrogen level on growth, yield and economics of dry land maize. Madras Agricultural Journal. 2009; 96(1-6):129-134.

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