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Influence of Sowing Dates and Hybrids on Growth and Yield of *Rabi* Maize in Coastal Andhra Pradesh

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ABSTRACT

A field experiment was conducted at Agricultural College Farm, Bapatla on sandy clayloam soil during the *rabi* 2012-13, to study the effects of sowing dates (from 15th November to 31st January at weekly interval) and hybrids (30V92, 900M and Sandhya) on maize growth and yield. Results indicated that higher growth and yield were observed with early date of sowing (15th November to 13th December), whereas among hybrids, higher grain yield of 5848 kg ha^{-1} was recorded with hybrid 30V92 followed by 5818 and 5445 kg ha^{-1} with Sandhya and 900 M, respectively.

Key words : Grain yield, Hybrids, Sowing dates.

Maize (*Zea mays* L.) is the most versatile crop with wider adaptability and the highest genetic yield potential among the food grain crops. Maize is considered a promising option for diversifying agriculture in various agro-climatic zones. The area, production and productivity of maize in India are 8.6 mha, 20.5 mt and 2.4 t ha^{-1}, respectively in 2010-11. India registered a growth rate of more than 7 per cent production and more than 6 per cent in productivity in the last five years (DMR, *Annual Report* 2011-12).

Among several agronomic practices, date of sowing is an important non-monetary input for realizing higher productivity in maize. The maximum productivity will be achieved by sowing the crop at optimum time which is mainly dependent on the agro-climatic conditions of the region. Temperature is one of the most important climatic events affecting the growth, phenology, development and yield of crops. In coastal environment of Andhra Pradesh, higher temperature and moisture stress at earlier stages of *kharif* crop (June-July sown) gives poor vegetative growth and further, heavy rain at harvesting stage causes severe crop lodging and rotting of grains. Choosing the appropriate sowing date is therefore, essential for increasing crop productivity by taking advantage of the available climatic resources. *Rabi* maize is an alternative for conditions like coastal Andhra Pradesh. There are ample evidences that maize yields are better when the crop is sown during *rabi* season (Karthikeyan, 2002). Its potential can, however, be exploited during the winter season owing to favourable climate, better water management and less attack of pests and diseases.

MATERIAL AND METHODS

A field experiment was conducted during *rabi*, 2012-13 at Agricultural College Farm, Bapatla. The soil was sandy clayloam (sand 20 %, silt 32 %, clay 48 %) with pH 7.7, organic carbon 0.57% and 194.4, 22.0 and 298.8 kg ha^{-1} of available N, P_2O_5 and K_2O, respectively. Maize seeds were dibbled at a spacing of 60 cm ×15 cm. The experiment was laid out in Randomized Block Design with factorial concept replicated thrice. There were twelve dates of sowing (sowing from 15th November to 31st January at weekly interval) and three hybrids (30V92, 900M and Sandhya). A uniform dose of 200 kg N, 70 kg each of P_2O_5 and K_2O ha^{-1} were applied in the form of urea, single superphosphate and muriate of potash. Entire quantity of phosphorus and potash and 1/3 of nitrogen was applied as basal. The remaining nitrogen was applied in two equal splits at knee high and tassel emergence stages. Data regarding the growth, yield and yield attributes were statistically analyzed by the combined analysis procedure to test differences among and within the different factors.

RESULTS AND DISCUSSION

Growth Parameters:

Plant height was the maximum (269.9 cm) with both 15th November and 13th December sowing, which were on a par with each other. There was significant decrease in plant height with further delay in sowing. Among hybrids, 249.6 cm plant height was with hybrid Sandhya followed by 244.7 cm with 30V92 and 239.1 cm with 900M (Table 1). Taller plants with early sowing might be due to lesser sunshine hours which tend to increase levels of the plant growth regulator auxin, which, in turn, encourages greater elongation of internodes. Similar results were also reported by Gaile (2012) and Verma *et al.* (2012). The maximum drymatter of 18610 kg ha^{-1} was produced with early sowing of 29th November with 900M followed by 22nd November sown Sandhya (18420 kg ha^{-1}) and 30V92 (18348 kg ha^{-1}). Increase in drymatter accumulation with 22nd November, 29th November and 13th December sowing (Table 1) could be due to optimum temperature, relative humidity during this period, bright sunshine hours coupled with higher crop growth days. Hussain *et al.* (2012) and Gaile (2012) observed higher drymatter production with early sowing as compared to late sowing.

Data presented in Table 2 on days to 50% tasseling revealed significant influence of dates of sowing only. The number of days taken for 50% tasseling was reduced with earlier sowing from 58.2 (15th November) to 56.4 (29th November). Further increase in days to 50% tasseling was observed till 3rd January which was the maximum (60.0 days). Similarly, Singh *et al.* (1990) reported a decrease in days to 50% tasseling with delay in sowing from 12th December to 5th January. Among dates of sowing (Table 2), the maximum days to 50% silking was taken with mid sowing (20th December to 3rd January) compared to early (15th November to 13th December) and late sowing (10th January to 31st January) which might be due to lower mean minimum temperature and higher bright sunshine hours which lead to more vegetative growth, thus increase in days to 50% silking. Similar results also observed by Singh *et al.* (1990) and Prodhan (2001).

Yield and yield attributes

The highest grains (712) was recorded with 22nd November with hybrid 900M which was significantly superior to that of 684 grains with 13th December sown Sandhya and 668 grains with 29th November sown 30V92 (Table 3). Higher number of grains per cob observed with early sowing might be due combined effect of accumulation of more photosynthates, cooler temperature with higher relative humidity during tasseling and silking and also to increased fertile ovules, further to develop more number of grains. Similar results were reported by Singh *et al.* (1987) and Jalia *et al.* (2008).

Data presented in Table 3 revealed that the maximum grain weight per cob was (198.4 g) followed by (197.5 g) were with crop sown on 13th December and 22nd November, respectively. It was higher with early sowing which could be attributed to cumulative effect of more number of grains per cob and higher 100-grain weight. Narwal *et al.* (1987) and Singh *et al.* (1987) also reported similar results.

Interaction between dates of sowing and hybrids which is presented in Table 4, revealed that the highest 100-grain weight was recorded with Sandhya (36.4 g) sown on 22nd November, which was significantly superior to 30V92 (35.1 g) and 900M (34.8 g) sown on

22nd November and 29th November, respectively. Higher 100-grain weight recorded with early sowing might be due to optimum weather conditions coupled with more number of growth days during reproductive stage which helped in transformation of more assimilates into grains and subsequently develop to bold grain during early sowing. These findings are in accordance with those of Jalia *et al.* (2008) and Awasthi *et al.* (2009).

The highest grain yield (9384 kg ha^{-1}) was with 22nd November sown 30V92 which was significantly superior to 8691 kg ha^{-1} with 29th November sown 900M and 8496 kg ha^{-1} with 22nd November sown Sandhya (Table 4). Early sowing of maize from mid November to mid December recorded significantly higher grain yield when compared to late sowing which might be due to combined effects of higher values for growth characters (taller plants and drymatter production) and yield attributing characters like, number of grains per cob, grain weight per cob, 100-grain weight, as well as favourable weather conditions that prevailed during grain filling and physiological maturity stages of the crop growth. The present results were in accordance with those of Jalia *et al.* (2008) and Awasthi *et al.* (2009).

Table 1. Plant height (cm) and drymatter production (kg ha^{-1}) of maize as influenced by dates of sowing and hybrids.

Dates of sowing		Plant height (cm)				Drymatter (kg ha^{-1})			
		30V92	900M	Sandhya	Mean	30V92	900M	Sandhya	Mean
November	15th	265.3	270.2	274.1	269.9	17821	16591	15973	16795
2012	22nd	255.4	251.7	276.9	261.3	18348	17750	18420	18173
	29th	271.5	280.8	277.5	276.6	16920	18610	17465	17665
	6th	259.1	263.4	255.8	259.4	16620	15328	15161	15703
December	13th	272.3	259.9	277.7	269.9	16006	17383	17099	16829
2012	20th	261.7	251.5	264.7	259.3	14499	14631	13346	14159
	27th	255.3	252.5	249.2	252.3	11348	9774	11689	10937
	3rd	272.1	238.0	261.5	257.2	12905	10613	11107	11542
January	10th	240.0	240.5	240.9	240.4	11161	10186	10102	10483
2013	17th	203.8	195.2	221.5	206.8	6663	8179	8695	7846
	24th	229.9	216.2	224.6	223.5	7483	5305	6084	6290
	31st	150.6	149.8	171.2	157.1	5787	2478	3158	3808
Mean		244.7	239.1	249.6		13149	12462	12566	
		SEm±	CD (0.05)	CV (%)		SEm±	CD (0.05)	CV (%)	
Date of sowing (D)		2.9	6.4	7.6		171	342	8	
Hybrid (H)		1.5	6.3			43	85		
Interaction (D x H)		6.2	NS			364	726		

Table 2. Days to 50% tasseling and days to 50% silking of maize as influenced by dates of sowing and hybrids.

Dates of sowing		Days to 50% Tasseling				Days to 50% Silking			
		30V92	900M	Sandhya	Mean	30V92	900M	Sandhya	Mean
November	15th	58.3	58.0	58.3	58.2	61.0	60.3	61.3	60.9
2012	22nd	57.3	56.7	56.7	56.9	62.0	61.0	61.3	61.4
	29th	56.3	57.0	56.0	56.4	61.0	59.3	60.0	60.1
	6th	58.0	58.0	58.7	58.2	62.7	61.0	61.3	61.7
December	13th	58.0	58.3	58.3	58.2	62.7	61.0	61.7	61.8
2012	20th	59.3	58.3	58.7	58.8	64.0	63.0	63.0	63.3
	27th	59.3	59.0	59.0	59.1	64.7	63.0	63.3	63.7
	3rd	59.7	60.0	60.3	60.0	64.0	62.7	63.3	63.3
January	10th	60.3	59.3	59.7	59.8	62.0	61.3	61.7	61.7
2013	17th	58.7	57.7	58.0	58.1	61.0	60.0	60.3	60.4
	24th	56.0	55.3	55.7	55.7	58.7	57.7	58.3	58.2
	31st	54.0	53.3	53.7	53.7	56.3	55.0	54.7	55.3
Mean		57.9	57.6	57.8		61.7	60.4	60.9	
		SEm±	CD (0.05)	CV (%)		SEm±	CD (0.05)	CV (%)	
Date of sowing (D)		0.1	0.2	1.1		0.1	0.2	1.1	
Hybrid (H)		0.1	NS			0.1	0.2		
Interaction (D x H)		0.2	NS			0.2	NS		

Table 3. Number of grains per cob and grain weight per cob (g) of maize as influenced by dates of sowing and hybrids.

Dates of sowing		No.of grains cob^{-1}				Grain weight cob^{-1} (g)			
		30V92	900M	Sandhya	Mean	30V92	900M	Sandhya	Mean
November	15th	580	679	620	626	173.0	180.2	170.8	174.6
2012	22nd	647	712	669	676	174.8	212.3	205.4	197.5
	29th	668	706	648	674	179.2	207.5	178.3	188.3
	6th	569	638	584	597	174.7	193.4	187.4	185.1
December	13th	603	728	684	672	196.0	205.6	193.5	198.4
2012	20th	656	684	648	662	184.2	190.9	184.9	186.7
	27th	552	654	496	567	137.7	186.1	135.9	153.2
	3rd	523	645	528	565	143.8	139.8	135.7	139.8
January	10th	528	537	524	530	139.1	120.5	136.4	132.1
2013	17th	416	517	487	473	39.6	45.0	49.3	44.7
	24th	387	565	497	483	37.0	37.8	41.5	38.8
	31st	429	461	423	438	26.9	27.4	33.0	29.7
Mean		532	654	547		13149	133.8	145.5	137.7
		SEm±	CD (0.05)	CV (%)		SEm±	CD (0.05)	CV (%)	
Date of sowing (D)		7	15	7		0.3	0.8	8.1	
Hybrid (H)		3	15			0.2	0.8		
Interaction (D x H)		14	30			0.8	1.6		

Table 3. 100-grain weight (g) and grain yield (kg ha^{-1}) of maize as influenced by dates of sowing and hybrids.

Dates of sowing		100-grain weight (g)				Grain yield (kg ha^{-1})			
		30V92	900M	Sandhya	Mean	30V92	900M	7144 9384	Mean
November	15th	32.8	28.4	31.4	30.9	8038	7549	8568	7577
2012	22nd	35.1	32.8	36.4	34.7	8494	8075	7240	8651
	29th	34.2	34.8	33.8	34.2	7801	8691	8542	8354
	6th	32.0	26.9	33.8	30.9	7617	6736	6388	7198
December	13th	31.4	30.2	33.1	31.6	7582	7915	5278	8013
2012	20th	34.3	30.1	35.7	33.4	6479	6714	4910	6527
	27th	29.6	29.2	30.4	29.8	4936	3941	4428	4718
	3rd	27.8	25.5	28.9	27.4	5625	4636	3584	5057
January	10th	26.3	24.2	28.4	26.3	4620	4276	2905	4441
2013	17th	21.8	22.3	24.6	22.9	2703	3113	1445	3133
	24th	21.6	20.1	22.8	21.5	3532	2413	5818	2950
	31st	20.0	17.5	20.8	19.4	2745	1284	CV (%)	1825
Mean		244.7	28.7	26.7		5848	5445	8	
		SEm±	CD (0.05)	CV (%)		SEm±	CD (0.05)		
Date of sowing (D)		0.3	0.8	8.1		76	168		
Hybrid (H)		0.2	0.8			38	164		
Interaction (D x H)		0.8	1.6			162	336		

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