Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(5): 34-37
Received: 23-07-2017
Accepted: 25-08-2017

VN Chudasama
Department of Agronomy
B. A. College of Agriculture
Anand Agricultural University,
Anand, Gujarat, India

VJ Patel
Department of Agronomy
B. A. College of Agriculture
Anand Agricultural University,
Anand, Gujarat, India

Priya K Patel
Department of Agronomy
B. A. College of Agriculture
Anand Agricultural University,
Anand, Gujarat, India

BD Patel
Department of Agronomy
B. A. College of Agriculture
Anand Agricultural University,
Anand, Gujarat, India

Correspondence
VN Chudasama
Department of Agronomy
B. A. College of Agriculture
Anand Agricultural University,
Anand, Gujarat, India

Feasibility of transplanting *Rabi* maize (*Zea mays* L.) varieties to varying age of seedling under middle Gujarat conditions

VN Chudasama, VJ Patel, Priya K Patel and BD Patel

Abstract
The experiment was conducted at the College Agronomy Farm, Anand Agriculture University, Anand during 2015-2016 to study the feasibility of transplanting maize varieties to varying age of seedling. The treatment included in the experiment were two varieties viz. Gujarat Maize 3 (GM 3) and High Quality Protein Maize (HQPM 1) and five age of seedling viz. 14, 21, 28, 35, and 42 day old. Results revealed that variety V_2 (HQPM 1) recorded significantly higher plant establishment per cent (96.38), plant height (11.20 cm) at 20 DATP, number of leaves plant^{-1} (18.75) at harvest, number of grains cob^{-1} (352), cob girth (11.23 cm), cob length (13.15 cm) as well as grain and straw yields. Significant variations in plant establishment per cent, plant height at 20 DATP, number of leaves plant^{-1} at 40 DATP, number of grains cob^{-1}, grain and straw yield was observed due to different varieties and age of seedling. Among all the treatment combinations, treatment combination V_2A_2 (HQPM 1 + Three weeks old seedling) recorded significantly higher plant establishment (97.50 %), number of grains cob^{-1} (443), grain yield (3405 kg ha^{-1}) and straw yield (4887 kg ha^{-1}) as compared to rest of the treatment combinations.

Keywords: Transplanted maize, yield, variety, age of seedling

1. Introduction
Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions and in production next to wheat and rice in the world. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. Ideal sowing time of *Rabi* maize lies in last week of October to mid-November in Gujarat but during winters where fields are not remain vacant in time (till November) due to existing of *kharif* crop. Delayed germination and plant growth receives a major setback due to late sowing of maize. Hence, grain yield reduces due to late sowing as the crop experiences high temperature with the advancement of growth which reduces the duration for grain filling and dry matter accumulation resulting in small grain size (Biswas *et al*. 2009) [7]. Reduction in the yield of maize can be compensated by transplantation technique. Badran (2001) [4] stated that under late sowing conditions, transplanting of maize may be a viable alternative to direct sowing. Sowing of maize is a traditional practice whereas, transplantation of maize is a recent technique. Transplantation technique in maize helps farmers to harvest a third crop in areas where none would have been possible because of late harvest of *Rabi* maize; as maize transplantation shortened the crop period of 8-10 days (Basu and Sharma, 2003) [5]. If maize seedlings are raised in nursery in the month of November and transplanted after harvesting of rice, the adverse effect of low temperature (delayed sowing) can be minimized. Therefore, transplanting of seedling may be an important area of study for maize cultivation considering the field duration and early plant establishment in Gujarat. Unfortunately, sizeable amount of works have not been reported on transplanted maize in India whereas in Gujarat, so far no any work was carried out as individual factor or in conjunction with other factor in transplanting of maize. Keeping all these facts in view the present field experiment was carried out to evaluate the performance of transplanted maize under midlands and to standardize an optimum age of seedling under middle Gujarat conditions.

2. Material Method
A field experiment was conducted during *Rabi* season of the year 2015-16 at College Agronomy Farm, Anand Agricultural University, Anand. The soil of the experiment field was loamy sand (Goradu) having 8.35 pH, 0.43 organic carbon, 217.42 kg/ha, available N, 45.72 kg/ha, available P_2O_5 and 256.69 kg/ha available K_2O. Average annual rainfall of 864.5 mm, which is realized entirely from the south-west monsoon currents.

The experiment was consisted of 10 treatment combinations with two factors studied under factorial randomized block design with four replications. The factor one with two varieties (V_1: GM 3 and V_2: HQPM 1) and second factor with five different age of seedling (A_1: two weeks old seedling, A_2: three weeks old seedling, A_3: four weeks old seedling, A_4: five weeks old seedling and A_5: six weeks old seedling). The seedlings of both the variety were raised in the nursery. The plot was kept ready through tractor drawn cultivator for preparing nursery beds. The five beds of 4 m long and 2.5 m wide were prepared. 500 kg of FYM applied to the beds and beds were leveled thoroughly. The seeds were sown in line keeping the 20 cm apart and covered with soil. The nursery was raised on different dates 09/11/2015, 16/11/2015, 23/11/2015, 30/11/2015 and 07/12/2015 as per the requirement of age of seedling i.e. two weeks, three weeks, four weeks, five weeks and six weeks old seedlings. The seedling of both the varieties GM 3 and HQPM 1 of different age were used for transplanting as per the treatments. The seedlings were transplanted keeping the row to row distance of 60 cm and plant to plant 20 cm in each plot. The first light irrigation was given to the crop before transplanting for better establishment. One healthy seedling was transplanted at each hill. The maize crop was fertilized with recommended dose of fertilizer (120:60:00 kg N, P_2O_5 and 20 kg $ZnSO_4$ ha^{-1}). Total quantity of phosphorus, zinc and 50 per cent of the nitrogen was applied in the soil at the time of transplanting. At 25-30 DATP, top dressed 25 per cent of the nitrogen and remaining 25 per cent nitrogen top dressed at 40-45 DATP. The N was supplied through urea and P was supplied through DAP while zinc was supplied through Zinc sulphate. In general, different weather parameters were favourable for plant growth during experimental period. The other package of practices was adopted to raise the crop as per the recommendations. In order to represent the plot five plants from each plot selected and labelled and all biometric observations was taken from selected plants. Data on various observations during the experiment period was statistically analysed as per the standard procedure developed by Cochran and Cox (1957) [8].

3. Results and Discussion

3.1 Effect of varieties

The results presented in Table 1 indicated that variety V_2 (HQPM 1) recorded significantly the highest plant establishment per cent (96.38). This observation suggests that age of seedling may be an important factor in establishment of plant in different varieties. The higher per cent establishment under HQPM-1 variety might be due to below-ground characteristics of plant root system that differentiate the establishment per cent. Different varieties showed their significant influenced on plant height measured at harvest whereas, it was non-significant when plant height measured at 20 and 40 DATP. Significantly higher plant height of 111.20 cm was recorded under treatment V_2 (HQPM 1) than that of treatment V_1 (GM 3) at harvest. Similar line of results reported by Anil and Sezer (2003) [3] they observed that there were significant differences between the cultivars in terms of plant height of sweet corn transplant. Further, number of leaves $plant^{-1}$ counted at advancement of crop growth stage was unaffected significantly due to varietal treatment at 20 DATP while significant differences were observed at 40 DATP and at harvest. At 40 DATP, both the varietal treatment differed statistically with each other wherein, significantly the highest and the lowest number of leaves $plant^{-1}$ was recorded under treatment V_2 (HQPM 1) and V_1 (GM 3), respectively. More or less similar line of results was also noticed at harvest.

With regards to yield attributes and yields, variety V_2 (HQPM 1) recorded significantly the highest number of grains cob^{-1} (352), cob girth (11.23 cm), cob length (13.15 cm), grain and straw yields. Anil and Sezer (2003) [3] also observed that there were significant differences between the cultivars in terms of number of grains and ear weight of transplanted sweet corn. Biswas (2008) [6] was also observed differences in cob length due to different maize varieties. Similar line of results was also reported by Mapfumo *et al.* (2007) [11] in pearl millet wherein, they noticed that variety PMV3 out yielded than PMV2.

3.2 Effect of age of seedling

Among all the age of seedling, treatment A_2 (Three weeks old seedling) was recorded significantly maximum plant establishment per cent of 96.88 at 20 DATP as compared to treatment A_5 (Six weeks old seedling). While significantly the lowest plant establishment per cent of 83.13 was observed under treatment A_5 (Six weeks old seedling) at 20 DATP. Murungu *et al.* (2006) [12] also observed that 20 day old transplants having a better plant stand than that of recorded under 30 and 40 day old transplants in pearl millet. Results reported in Table 1 revealed that increasing age of seedling there was linearly increased the plant height of maize from treatment A_1 to A_5 at 20 DATP wherein, treatment A_5 (Six weeks old seedling) was recorded significantly maximum plant height of 36.76 and 48.53 cm at 20 and 40 DATP, respectively. The results are accordance with the results of Kumar *et al.* (2014) [10]. They reported that transplantation of 7 weeks old seedling attained maximum plant height at 30 and 60 days after transplanting but 90 DAT the plant height of 5 weeks old transplanted seedling was recorded maximum. Whereas, significantly the lowest plant height was measured in treatment A_1 at 20 and 40 DATP, respectively. Agbaje and Olofintoye (2002) [1] also observed shorter plant height in transplant of 8 weeks old seedling of sorghum. This could be due to transplanting shock experienced during uprooting from the nursery. This may be attributed to the ability of plants to easily regenerate new roots after transplanting and resume active nutrient uptake. At harvest, treatment A_2 (Three weeks old seedling) recorded the highest plant height of 127.79 cm while, treatment A_5 (Six weeks old seedling) recorded the lowest plant height of 85.71 cm. Age of seedling showed unequivocally significant differences in number of leaves $plant^{-1}$ at 40 DATP and at harvest but fail to exert their significant influence on number of leaves $plant^{-1}$ at initial duration *i.e.* at 20 DATP. Treatment A_4 (Five weeks old seedling) recorded significantly higher number of leaves $plant^{-1}$ (9.88) as compared to rest of the treatments except treatment A_2 at 40 DATP. At harvest, treatment A_1 (Two weeks old seedling), A_2 (Three weeks old seedling), A_3 (Four weeks old seedling), A_4 (Five weeks old seedling) and A_5 (Six weeks old seedling) differed significantly from each other wherein, treatment A_2 (Three weeks old seedling) recorded significantly the highest number of leaves $plant^{-1}$ (20.75) while the lowest value (12.13) was noticed under treatment A_5 (Six weeks old seedling). Dale and Drennan (1997) [9] also observed that among all the transplanted age of seedling, 45 day old transplants formed fewer leaves than the younger transplants. The lower leaves under 45 day old transplant might be due to older transplants were long and thin and had almost grown out before planting, so they experienced particularly severe transplanting shock hence, plants are

unable to perform well with respect to producing the higher number of leaves.

Treatment A_2 (Three weeks old seedling) recorded significantly maximum number of cob length, cob girth and grains cob^{-1} while treatment A_5 (Six weeks old seedling) recorded significantly minimum number of cob length, cob girth and grains cob^{-1}. The results are in accordance with the results of Kumar *et al.* (2014) [10] wherein, they reported that the enhanced vegetative growth in terms of leaf area index, dry matter accumulation and root volume resulted in more grains per cob.

The result indicated that increasing the age of seedling linearly decrease the grain yield and straw yield of maize from treatment A_2 (Three weeks old seedling) to A_5 (Six weeks old seedling) wherein, treatment A_2 (Three weeks old seedling) showed supremacy by recording significantly the highest grain yield (2963 kg ha^{-1}). This might be due to abrupt switch off from growth phase to reproductive phase and more reduction in crop duration as compared to others. Higher straw yield under treatment A_2 (three weeks old seedling) can be explained by the fact that plant transplanted with lesser age of seedling resulted in more number of leaves and root biomass which contributed towards increased source-sink relationship within the plant which increased dry matter accumulation by plant and there by higher straw yield.

3.3 Interaction effect

The interaction effect between different varieties and age of seedling brought significant variations in number of grains cob^{-1} (Table 2), grain and straw yield (Table 3). Number of grains cob^{-1} was significantly higher under V_2A_2 (HQPM 1 + Three weeks old seedling). Significantly higher grain and straw yield was recorded under treatment combination V_2A_2 (HQPM 1 + Three weeks old seedling) and found to be significantly superior over rest of treatment combinations. Higher yield under V_2 variety showed the response of age of seedling with this variety. The lower yield under V_1A_5 combination may be attributed to consequently yield attributes were adversely affected and ultimately produced lesser crop yield over 4, 5 and 6 weeks transplanted maize. The results confirm the findings of Andreas and Ransom (2002) [2] on winter transplanted maize.

Table 1: Growth, yield attributes and yields of maize as influenced by varieties and age of seedling

Treatment	Plant establishment (%)	Plant height (cm)			Number of leaves plant^{-1}			Number of grains cob^{-1}	Cob girth (cm)	Cob length (cm)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
	At 20 DATP	At 20 DATP	At 40 DATP	At Harvest	At 20 DATP	At 40 DATP	At Harvest					
Varieties (V)												
V_1: GM 3	89.38	22.71	41.83	106.14	5.85	8.85	15.80	243	9.64	9.74	1844	2778
V_2: HQPM 1	96.38	23.60	40.81	111.20	6.00	9.35	18.75	352	11.23	13.15	2447	3728
S.Em.+	0.78	0.415	0.638	1.52	0.13	0.16	0.27	5.33	0.189	0.34	42	63
C. D. at 5%	2.25	NS	NS	4.42	NS	0.47	0.78	15.47	0.54	0.99	121	183
Age of seedling (A)												
A_1: Two weeks	95.94	13.23	35.18	112.39	5.75	8.75	19.50	364	10.93	12.81	2402	3573
A_2: Three weeks	96.88	18.29	41.78	127.79	5.88	9.13	20.75	402	11.08	13.30	2963	4210
A_3: Four weeks	95.00	20.55	40.73	116.95	5.50	9.00	18.25	307	10.56	11.37	2129	3268
A_4: Five weeks	93.44	26.95	40.39	99.76	6.25	9.88	15.75	223	10.08	10.50	1766	2822
A_5: Six weeks	83.13	36.76	48.53	86.46	6.25	8.75	12.13	193	9.54	9.25	1468	2391
S.Em.+	1.23	0.656	1.009	2.41	0.20	0.26	0.42	8.43	0.30	0.54	67	99
C. D. at 5 %	3.56	1.90	2.93	6.98	NS	0.75	1.23	24.47	0.85	1.56	191	284
V x A	Sig.	Sig.	NS	NS	NS	Sig.	NS	Sig.	NS	NS	Sig.	Sig.
C.V (%)	3.73	8.01	6.90	6.26	9.62	8.00	6.95	8.01	10.93	12.81	8.46	8.85

Table 2: Number of grains cob^{-1} as influenced by interaction effect of different varieties and age of seedling

Number of grains cob^{-1}					
Treatments	**A_1**	**A_2**	**A_3**	**A_4**	**A_5**
V_1	325	361	231	159	139
V_2	402	443	382	287	247
S. Em. ±	11.92				
C. D. at 5 %	34.60				
C. V. %	8.01				

Table 3: Grain and Straw yield as influenced by interaction effect of different varieties and age of seedling

yield (kg ha^{-1})										
Treatments	**A_1**		**A_2**		**A_3**		**A_4**		**A_5**	
	Grain	**Straw**	**Grain**	**Straw**	**Grain**	**Straw**	**Grain**	**Straw**	**Grain**	**Straw**
V_1	2169	3259	2521	3533	1691	2620	1427	2282	1310	2094
V_2	2635	3887	3405	4887	2466	3817	2104	3363	1627	2687
	Grain					Straw				
S. Em. ±	93					141				
C. D. at 5 %	269					408				
C. V. %	8.46					8.85				

Conclusion

From the above findings, it is concluded that higher grain yield, net realization and benefit cost ratio (BCR) of *Rabi* maize could be achieved with transplanting of maize varieties either HQPM 1 or GM 3 with three weeks old seedling under middle Gujarat conditions.

References

1. Agbaje GO, Olofintoye JA. Effect of transplanting on yield and growth of grain sorghum (*Sorghum bicolor* L.)., Tropicultura. 2002; 20(4):217-220.
2. Andreas O, Ransom JK. Response of maize varieties to transplanting in Striga infested fields., Weed Science, 50 2002; (3):392-96.
3. Anil H, Sezer I. A study on the effects of different sowing time and transplanting on the yield, yield components and some quality characteristics in sweet corn at Carsamba Plain., O M U Ziraat Fak. Dergisi. 2003; 18(2):17-23.
4. Badran MSS. Effect of transplanting and seedling age on grain yield and its components of some maize cultivars. Alexandria Journal of Agricultural Research. 2001; 46(2):47-56.
5. Basu S, Sharma S. Effect of transplanting on vegetative, floral and seed characters of maize (*Zea mays* L.) parental lines in spring-summer season., Indian Journal of Agriculture Science. 2003; 73(1):44-48.
6. Biswas M. Effect of seedling age and variety on the yield and yield attributes of transplanted maize. International Journal of Sustainable Crop Production. 2008; 3(6):58-63.
7. Biswas M, Islam N, Islam S, Ahmed M. Seedling raising method for production of transplanted maize. International Journal of Sustainable Crop Production. 2009; 4(2):6-13.
8. Cochran WG, Cox GM. Experimental designs. John Willey and Sons. Inc., New York. 1957, 546-568.
9. Dale AE, Drennan DSH. Transplanted maize (*Zea mays* L.) for grain production in southern England as effect of planting date, transplant age at planting and cultivar on growth, development and harvest index., Journal of Agriculture Science. 1997; 128:37-44.
10. Kumar S, Shivani, Kumar S. Performance of transplanted maize (*Zea mays*) under varying age of seedling and method of nursery raising in the midlands of eastern region., Indian Journal of Agricultural Sciences. 2014; 84(7):877-82.
11. Mapfumo S, Chiduza C, Young EM, Murungu FS, Nyamudeza P. Effect of cultivar, seedling age and leaf clipping on establishment, growth and yield of pearl millet (*Pennisetum glaucum*) and sorghum (*Sorghum bicolor*) transplants., South African Journal of Plant and soil. 2007; 24(4):202-208.
12. Murungu FS, Nyamudeza P, Mugabe FT, Matimati I, Mapfumo S. Effects of seedling age on transplanting shock, growth and yield of pearl millet (*Pennisetum glaucum* L.) varieties in semi-arid Zimbabwe., Journal of Agronomy, 2006; 5(2):205-211.