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Optimum Time of Pollination and Number of Fruit Pickings and Its Effect on Seed Yield in CGMS Based Chilli (*Capsicum annuum* L.) Hybrid

Neha Thakur[1*], S. N. Vasudevan[2], S. R. Doddagoudar[3], B. V. Tembhurne[3], Sangeeta I. Macha[3] and M. G. Patil[3]

[1]School of Agriculture, LPU Phagwara 144411, India.
[2]ZARS, V. C. Farm, Mandya, UAS, Bengaluru-571405, Karnataka, India.
[3]College of Agriculture, UAS, Raichur-584104, Karnataka, India.

Authors' contributions

This work was carried out in collaboration among all authors. Authors SNV and BVT designed the study. Author NT performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors NT and SRD, SNV managed the analyses of the study. Authors NT, SRD, SIM and MGP managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

This study proposed standardization of best time of pollination and stage of picking fruits in newly released chilli CGMS hybrid. As optimum pollination time can result in better fruit set and thus produce seeds with superior yield. Another purpose of conducting the experiment was selection of a fruit picking stage that positively influence the seed yield parameters as under matured or over matured fruits often cause losses. In present investigation during *kharif* season of 2016 and 2017stigma of A line (male sterile line) was pollinated at six different times with pollens from R line (male fertile/restorer line) starting from 9 am to 5 pm. Fruits labeled with different coloured threads were harvested 60 days after pollination in three different pickings. Pollination time 10 to 11 am yielded hybrid with higher fruit set (40 %), dry fruit weight (1.50g), seed weight per fruit (0.451 g), number of seeds per fruit (76) and test weight (6.26 g) as compared to late afternoon timings. Also second picking fruits were better in these seed yield parameters when compared to early and late pickings. The interaction effect was also significant for these two objectives.

**Corresponding author: E-mail: nthakursst0708@gmail.com;*

Keywords: CGMS; pollination time; fruit picking; seed yield; test weight.

1. INTRODUCTION

Chilli (*Capsicum annuum* L.) termed as Kapsimo, Mensinkaayi, Mirch, etc in many vernacular languages is a member of the nightshade family called Solanaceae. Originated in the new world tropics and subtropics with evidences found in Peru, this spice and vegetable crop is cultivated commercially across the world. In view of its introduction to India from Brazil by Portuguese towards the end of fifteenth century, India has become the secondary centre of diversity for chilli. It holds a high economic value as India is the world leader in chilli production followed by China, Mexico, Turkey, Indonesia, Spain and United States [1]. This spice-cum -vegetable has gained popularity due to its nutritional as well medicinal value. It is a rich source of calcium, magnesium, Vit C, A B6 and Iron. Capsaicin is a bioactive compound found in chilli that has antibacterial and anti inflammatory properties. Moreover chiilli is also contemplated as an immunity booster [2].

The five main species of chilli viz., *C frutescens* L., *C. chinense* Jacquin, *C. pendulum* Willdenow, *C. pubescens* Ruiz & Pavon and *C. annuum* are cultivated throughout the world. Among the breeding method evolved in development of *C. annuum* hybrids, pollination and use of Cytoplasmic Genetic Male Sterility (CGMS) is the most acknowledge. Adopting it as technique of hybrid seed production in chilli may reduce the cost of hybrid seed production by 50 % by reducing labour requirement for emasculation [3]. Chilli is an often cross pollinated crop with natural crossing ranging from 7.6 to 36.8 per cent out crossing. Hybrid chilli crop contribute for high vigour, uniformity, disease resistance, stress tolerance and good horticultural traits including earliness and long shelf-life with consistent stable high yield. Albeit crossing can be done at any moment during day hours but the best time of pollinating is during morning and late afternoon when flowers have attained the balloon or mature bud stage. Further to reap seeds with exceptional seed quality standards and genetic purity it is always essential to pollinate maximum flowers at the best time. Pollinating tomato crop at 11 am resulted in highest 100 seed weight, seed yield per berry, number of seed as well as germination percentage [4]. Seeds of fruits harvested at highest physiological maturity contribute to better germination because of higher seed qualitative and quantitative levels [5] as compared to over or under matured fruits. Therefore standardizing the best time of pollination and right stage of fruit maturity and its effect on the CGMS based chilli hybrid seed yield was the aim of present investigation.

2. MATERIALS AND METHODS

The best quality seeds of A line and R line were procured from the plant breeder to produce seeds of CGMS based chilli hybrid UARChH42 (JCH42). After nursery, seedlings were transplanted onto the main field of Seed Science and Technology, University of Agricultural Sciences, Raichur, Karnataka (India) during *kharif* 2016 and 2017. Female and male plants were planted separately in ratio of 75:25 respectively. At initiation of flowering which was 50 days after transplanting the stigma of A line (male sterile line) was pollinated by pollens of flowers collected on the spot from R line (male fertile line) at six different times of the day starting from 9 am to 5 pm with different coloured threads. It was continued till the end of crossing period. Physiologically matured red dried chilli fruits developed 60 days after pollination were harvested in three pickings. Fruits developed from crossing female flower in mid-September to mid-October were harvested in month of November as first picking. Fruits developed from crossing female flower in mid-October to mid-November, were harvested in month of December as second picking. Fruits developed from crossing female flower in mid-November to mid-December were harvested in the month of January as third picking. The experimental was laid out in Factorial Randomized Complete Block Design.

For each treatment yield parameters were recorded viz., fruit set (%), dry fruit weight (g), seed weight per fruit (g), number of seeds per fruit, and test weight (g). The per cent fruit set was calculated as per below mentioned formula.

$$\text{Fruit set \%} = \frac{\text{Number of fruits harvested}}{\text{Total number of buds pollinated}} \times 100$$

3. RESULTS AND DISCUSSION

Pollinating chilli flowers at 10 -11 am recorded higher fruit set (38.06 and 40.36), fruit weight (1.49 and 1.50), seed weight per fruit (0.449 and 0.452), number of seeds per fruit (76.53 and 76.81), test weight (6.21 and 6.26) in 2-16 and 2-

17 respectively (Table 1). This increase in seed quantitative characters might be due to higher anther dehiscence and availability of pollen in abundance due to optimum weather in morning

Table 1. Effect of time of pollination and number of fruit pickings on seed yield in chilli hybrid UARChH42 (JCH42)

Treatments	Fruits set (%)		Dry fruit weight (g)		Seed weight per fruit (g)		No. of seeds per fruit		Test weight (g)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Main effect (Pollination time- T)										
T_1	34.42	34.93	1.34	1.31	0.370	0.383	63.47	64.54	5.22	5.30
T_2	38.06	40.36	1.49	1.50	0.449	0.452	76.53	76.81	6.21	6.26
T_3	31.64	33.40	1.28	1.32	0.339	0.343	63.32	64.96	5.34	5.33
T_4	32.23	31.56	1.43	1.45	0.402	0.423	72.80	74.61	5.67	5.92
T_5	29.87	30.72	1.32	1.32	0.351	0.357	59.42	60.84	5.18	5.23
T_6	26.89	28.46	1.26	1.22	0.340	0.339	54.81	56.43	5.00	5.28
S. Em±	0.77	1.02	0.011	0.015	0.009	0.007	0.91	0.82	0.071	0.051
CD @ 5 %	2.21	2.94	0.031	0.043	0.025	0.020	2.62	2.36	0.203	0.147
Main effect (Fruit picking- P)										
P_1	32.32	32.56	1.36	1.36	0.375	0.382	64.91	66.99	5.37	5.51
P_2	34.08	35.38	1.40	1.39	0.394	0.398	69.06	68.91	5.70	5.79
P_3	30.16	31.76	1.30	1.32	0.357	0.369	61.21	63.19	5.24	5.36
S. Em±	0.54	0.72	0.008	0.011	0.006	0.005	0.65	0.58	0.050	0.036
CD @ 5 %	1.57	2.08	0.022	0.030	0.018	0.014	1.86	1.67	0.144	0.104
Interaction effect (T×P)										
T_1P_1	34.92	34.29	1.36	1.32	0.393	0.401	67.31	69.29	5.15	5.31
T_1P_2	35.31	36.82	1.37	1.36	0.372	0.398	67.63	67.79	5.29	5.35
T_1P_3	33.03	33.67	1.31	1.25	0.345	0.351	55.48	56.54	5.23	5.25
T_2P_1	36.39	38.18	1.47	1.48	0.429	0.437	74.77	74.28	6.17	6.38
T_2P_2	42.03	44.92	1.56	1.58	0.475	0.476	82.34	84.45	6.78	6.69
T_2P_3	35.77	37.97	1.43	1.45	0.445	0.444	72.47	71.71	5.68	5.70
T_3P_1	31.17	33.57	1.29	1.32	0.310	0.311	64.05	66.26	5.32	5.28
T_3P_2	32.80	34.34	1.31	1.34	0.377	0.379	66.45	65.33	5.51	5.50
T_3P_3	30.97	32.30	1.23	1.31	0.330	0.338	59.47	63.29	5.21	5.19
T_4P_1	32.80	31.09	1.44	1.45	0.402	0.418	71.75	74.84	5.49	5.54
T_4P_2	34.36	34.60	1.47	1.49	0.414	0.428	77.69	75.36	6.18	6.64
T_4P_3	29.53	28.98	1.38	1.41	0.390	0.424	68.96	73.64	5.34	5.57
T_5P_1	31.79	30.40	1.34	1.35	0.372	0.376	56.25	59.63	5.22	5.22
T_5P_2	31.33	32.91	1.39	1.35	0.382	0.369	64.41	64.02	5.24	5.25
T_5P_3	26.49	28.84	1.23	1.26	0.298	0.326	57.59	58.86	5.09	5.22
T_6P_1	26.82	27.86	1.24	1.23	0.342	0.346	55.32	57.66	4.89	5.33
T_6P_2	28.67	28.69	1.33	1.21	0.344	0.340	55.84	56.50	5.24	5.31
T_6P_3	25.19	28.83	1.22	1.21	0.334	0.330	53.28	55.12	4.87	5.21
Mean	32.19	33.24	1.35	1.35	0.375	0.383	65.06	66.36	5.44	5.55
S. Em±	1.33	1.77	0.018	0.026	0.015	0.012	1.58	1.42	0.122	0.088
CD @ 5 %	NS	NS	NS	NS	0.043	0.035	4.55	4.09	0.352	0.254

T_1 = 9 to 10 am; T_2 = 10 to 11 am; T_3 = 11 to 12 pm; T_4 = 2 to 3 pm; T_5 = 3 to 4 pm; T_6 = 4 to 5 pm; P_1 = 1st picking; P_2 = 2nd picking; P_3 = 3rd picking; T_1P_1= 9 to 10 am + 1st picking; T_1P_2 = 9 to 10 am + 2nd picking; T_1P_3 = 9 to 10 am + 3rd picking; T_2P_1 = 10 to 11 am + 1st picking; T_2P_2 = 10 to 11 am + 2nd picking; T_2P_3 = 10 to 11 am + 3rd picking; T_3P_1 = 11 to 12 pm + 1st picking; T_3P_2 = 11 to 12 pm + 2nd picking; T_3P_3 = 11 to 12 pm + 3rd picking; T_4P_1= 2 to 3 pm + 1st picking; T_4P_2= 2 to 3 pm + 2nd picking; T_4P_3 = 2 to 3 pm + 3rd picking; T_5P_1= 3 to 4 pm + 1st picking; T_5P_2 = 3 to 4 pm + 2nd picking; T_5P_3 = 3 to 4 pm + 3rd picking; T_6P_1= 4 to 5 pm + 1st picking; T_6P_2= 4 to 5 pm + 2nd picking; T_6P_3 = 4 to 5 pm + 3rd picking

hours and more stigma receptivity which yielded heavy fruits with more number of heavier and bolder seeds contributing higher seed weight [6], [7]. Whereas lowest values of these parameters were recorded in T_6 (4 to 5 pm) which could be due to low availability of pollen as well as lesser stigma receptivity in the evening time which produced seeds [8], [9]. Also P_2 (2^{nd} picking) of fruits recorded highest fruit set (34.08 and 35.38), dry fruit weight (1.40 and 1.39), fruit weight (1.49 and 1.50), seed weight per fruit (0.449 and 0.452), number of seeds per fruit (76.53 and 76.81), and test weight (6.21 and 6.26) (Table 1). Further the interaction due to time of pollination (10-11 am) and fruit pickings (2^{nd} picking) was also found to be significant for various seed yield parameters. This might be because fruits were completely developed and physiologically matured which favoured maximum accumulation of food reserves, amino acids, phosphorus active substances, dry matter, sugar and other water soluble protein [10], [11]. Whereas lowest seed yield parameters were recorded in P_3 (3^{rd} picking) which may be due to loss in seed weight resulting from more dead or immature seeds. This could be attributed due to non-availability of sufficient nutirents in the seeds as the complete utilization of applied fertilizers as well as plant nutrients by the earlier set fruits.

The interaction showed significant effect on some of the yield parameters among the treatments. Maximum seed weight per fruit (0.475 g in 2016, 0.476 g in 2017), number of seeds per fruit (82.34 in 2016, 84.45 in 2017) and test weight (6.78 in 2016, 6.69 g in 2017) was observed in T_2P_2 (10 to 11 am + 2^{nd} picking). It might be due to the interaction of the optimum pollination time and best climate for fruit development which gave more yield.

4. CONCLUSION

From present experiment it can be concluded that 10 to 11 am pollination time is best for crossing female line as it resulted in better seed set of chilli hybrid UARChH42 (JCH42). Also fruits harvested in second picking can yield maximum seed yield parameters.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. SJ, Subbiah A. Production and marketing of chillies. 2012;9–15.
2. Chakrabarty S, Islam AKMM, Islam AKMA. Nutritional benefits and pharmaceutical potentialities of chili: A review. Fundam. Appl. Agric. 2017;2(2):227–232.
   DOI: 10.5455/faa.CITATION
3. Aulakh PS, Dhaliwal MS, Jindal SK, Schafleitner R, Singh K. Mapping of male sterility gene ms10 in chilli pepper (*Capsicum annuum* L.). Plant Breed. 2016; 135(4):531–535,
   DOI: 10.1111/pbr.12389
4. Vidyadhar B, Tomar BS, Singh B, Kaddi G. Effect of growing conditions on growth, seed yield and quality attributes in cherry tomato (*Solanum lycopersicum* var cerasiferme). Indian Journal of Agricultural Sciences. 2015;85(1):114-117.
5. Kalyanrao, Tomar BS, Singh B. Effect of stage of harvest and post harvest ripening on hybrid seed yield and quality in bottle gourd. Indian J. Hortic. 2014;71(3): 428–432.
6. Chattopadhyay A. Effect of emasculation time on fruit set and hybrid seed yield in brinjal under Old Alluvial Zone of West Bengal. Journal of Interacademicia. 2000; 4(3):470-473.
7. Kalyanrao, Tomar BS, Singh B, Aher BM. Effect of pollination time on fruit set, seed yield and seed quality of bottle gourd cv. Pusa hybrid-3. BIOINFOLET-A Quarterly Journal of Life Sciences. 2015;12(1a):90-94.
8. Kivadasannavar P, et al. Studies on emasculation and pollination in hybrid seed production of chilli (*Capsicum annuum* L .)*. Department of Seed Science and Technology Abstract: Field experiments were conducted during *kharif* 2006 and 2007 at Agricultural Research Station , Bailho. 2009;22(2):301–305.
9. Sandra N. Stidies on hybrid seed production in bitter gourd. National seed congress Poster Presentation; 2012.

10. Yogeesha HS, Nagaraja A, Sharma SP. Pollination studies in hybrid tomato seed production. Seed Science and Technology. 1999;27(1):115-122.

11. Dayal A, Vs M, Os D, Rc P, Ovais H. Effect of pickings on seed quality parameters of *Gossypium hirsutum* L. varieties. 2017; 6(4):858–862.

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