Eco. Env. & Cons. 29 (August Suppl. Issue) : 2023; pp. (S90-S93)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i04s.014

Effect of Sowing Time and Covering Material on Growth and Yield Parameters of Off-Season Grown Watermelon under Low Tunnel

Poonam[1]*, S.S. Lakhawat[2], S.K. Sharma[3], Shalini Pilania[4], H.K. Jain[5] and S.S. Sisodia[6]

[1,2,4*]Rajasthan College of Agriculture, Department of Horticulture, MPUAT, Udaipur, Rajasthan, India MPUAT, Udaipur, Rajasthan, India
[3]ICAR, New Delhi, India
[5]Department of Statistics, Rajasthan College of Agriculture, RCA, Udaipur, India
[6]Rajasthan College of Agriculture, Department of Extension Education, RCA, Udaipur, India

(Received 13 February, 2022; Accepted 15 April, 2023)

ABSTRACT

Field trial was carried out at sericulture farm of RCA, Udaipur to investigate the response on growth and yield parameters of watermelon grown on different sowing time under low tunnel covered by different covering material during two consecutive years, *i.e.* 2020-21 & 2021-22 and also in pooled analysis. Watermelon crop was sown at three sowing date (*i.e.* S_1 : 15th December, S_2 : 30th December and S_3 : 15th January) and four covering materials (*i.e.* C_0 : no covering, C_1 : covering with polythene sheet, C_2 : covering with non-woven and C_3 : covering with insect net)were used for covering of low tunnels for off season(*i.e.* winter season) grown watermelon during both the years, i.e. 2020-21 and 2021-22. Distinctmeteorological parameters were observedin asystematicway under each treatment combination. Results showed that comparatively higher range of air temperature, relative humidity and light intensity were observed under treatment S_1C_1 (*i.e.* sowing date of 15th December + covering of polythene sheet) which influenced the growth of watermelon at all stages as reproduced through higher plant biomass and subsequently the fruit yield.

Key words: *Watermelon, Low tunnel, Polythene sheet, Non-woven polypropylene, Insect net*

Introcuction

Watermelon is economically most important vegetable crops in India. Due to its origin, watermelon has some typical requirements toward growing condition and especially high requirements toward heat in all stages of growth and development. Open field production on soil mulched with plastic mulch is the dominant agricultural practices. Since recently, areas under watermelon production in low tunnels are increasing. The use of different covering material gives significant results in early production of almost all vegetable crops, but mostly in warm season vegetables which are sensitive to low temperatures (Butler and Ross, 1999). In fact, this technique could be increasingly necessary to mitigate adverse effects of climate change on fruit growing (Carlen and Kruger, 2009). This study aimed to analyses the Ef-

Abbreviations
RCA – Rajasthan college of Agriculture
S – Sowing date
C – Covering material.

([2]Professor, [3]Professor & ADG (HRM), [4]Assistant Professor) fect of sowing time and covering material on growth and yield parameters of off-season grown watermelon under low tunnel.

Materials and Methods

This work was carried out at Udaipur, situated under agroclimatic condition of the sub-humid southern plain of Rajasthan state (India). The research work was subjected to Factorial RBD with three replications duringmid-winter to early summer (*i.e.* mid Dec. to April) as an off season crop during both the year 2020-21 and 2021-22. A well-established low tunnel structure was built for off season cultivation of watermelon crop at Sericulture Farm, RCA, Udaipur. Prior to planting the seed on the beds, flexible iron hoops were manually erected at a distance of 1.5 m on each bed. For making low tunnels, the width of two ends of iron hoops was retained 70 cm, with a height of 60-70 cm above the levels of the beds for holding the covering material was utilized treatment wise on the beds. The treatment was three times of sowing *i.e.* 15th December, 30th December and 15th January and four different types of covering material *i.e.* no covering, polythene sheet, non-woven polypropylene and insect-net was used. Mean values of different attributes were used for statistical analysis. The data were observed on germination percentage, vine length, number of branches per vine, number of leaves per vine, number of nodes per vine, fruit weight, number of fruits per plant and fruit yield per plant.

Results

Growth parameters

The data of several growth parameters recorded at different stages of watermelon crop grown under low tunnels were significantly influenced by different date of sowing and covering materials at 5 % level of significanceduring both the years of study *i.e.* 2020-21& 2021-22 as well as in pooled analysis. Notably, the best treatmentwith having the desirable highest values of parameters during 2020-21, 2021-22 and in pooled analysis viz.,germination percentage (*i.e.* 88.19, 89.48 and 88.83 per cent) (Fig. 1), vine length at last harvest (2.00, 2.19 and 2.09 m),

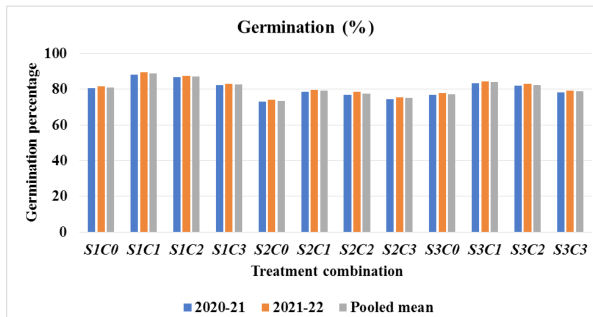

Fig. 1. Interaction effect of sowing date and covering material on germination percentage of watermelon

Table 1. Interaction effect of sowing date and covering material on germination percentage (%), vine length at last harvest, number of branches per vine and number of leaves per vine at last harvest

Treatments	Germination percentage (%)			Vine length at last harvest (m)			Number of branches per vine at last harvest			Number of leaves per vine at last harvest		
	2020-21	2021-22	Pooled mean	2020-21	2021-22	Pooled mean	2020-21	2021-22	Pooled mean	2020-21	2021-22	Pooled mean
1.S_1C_0	80.61	81.51	81.06	1.68	1.88	1.78	4.26	4.74	4.50	73.84	80.75	77.29
2.S_1C_1	88.19	89.48	88.83	2.00	2.19	2.09	5.33	5.74	5.54	94.21	100.91	97.56
3.S_1C_2	86.68	87.65	87.17	1.87	2.04	1.95	5.10	5.13	5.11	84.74	96.46	90.60
4.S_1C_3	82.47	83.11	82.79	1.77	1.97	1.87	4.85	4.90	4.87	79.49	86.70	83.09
5.S_2C_0	73.05	74.06	73.56	1.53	1.74	1.64	3.32	3.26	3.29	68.09	72.04	70.06
6.S_2C_1	78.73	79.70	79.21	1.85	2.01	1.93	3.86	4.39	4.12	77.13	81.37	79.25
7.S_2C_2	76.73	78.55	77.64	1.73	1.93	1.83	3.72	4.14	3.93	75.80	79.72	77.76
8.S_2C_3	74.48	75.44	74.96	1.65	1.82	1.73	3.48	3.91	3.69	69.84	73.71	71.78
9.S_3C_0	76.83	77.79	77.31	1.60	1.82	1.71	3.37	3.84	3.60	71.59	77.58	74.58
10.S_3C_1	83.52	84.38	83.95	1.87	2.04	1.95	4.17	4.53	4.35	83.84	94.23	89.03
11.S_3C_2	81.94	82.88	82.41	1.78	1.99	1.88	3.81	4.49	4.15	80.22	85.27	82.75
12.S_3C_3	78.30	79.31	78.80	1.70	1.92	1.81	3.86	3.97	3.91	76.57	79.69	78.13
SEm±	0.07	0.13	0.06	0.006	0.005	0.003	0.03	0.02	0.01	0.53	0.73	0.37
CD@5%	**0.19**	**0.37**	**0.17**	**0.018**	**0.013**	**0.009**	**0.07**	**0.05**	**0.04**	**1.50**	**2.06**	**1.03**

number of branches per vine at last harvest (5.33, 5.74 and 5.54), number of leaves per vine at last harvest (94.21, 100.91 and 97.56) and number of nodes per vine at last harvest (78.38, 82.39 and 80.39) was recordedunder treatment combination of S_1C_1 (*i.e.*sowing date of 15th December + covering of polythene sheet) in comparison of all other treatment combinations (Table 1 to 2).

Yield parameters

A perusal of data indicated that fruit weight, number of fruits per plant and fruit yield per plant (Table 2) were significantly influenced by combined effect of sowing date and covering materials. The parameters *i.e.* yield per plant (*i.e.* 10.33, 11.13 and 10.73 kg, respectively during 2020-21, 2021-22 and in pooled analysis), number of fruits per plant (3.63, 3.73 and 3.68 respectively during 2020-21, 2021-22 and in pooled analysis) and fruit yield per plant (10.33, 11.13 and 10.73 kg, respectively during 2020-21, 2021-22 and in pooled analysis) was recorded the highest in treatment combination of sowing date of 15th December + covering of polythene sheet than all other treatment combinations as compared to all other treatment combination.

Discussion

The higher biomass in treatment combination S_1C_1 (*i.e.* sowing date of 15th December + covering of polythene sheet) was due to availability of optimum range of photosynthetic active radiation, high relative humidity and favourable temperature range during the cropping period. Furthermore, diffused photosynthetic active radiation under low tunnels covered by polythene sheet in contrast to direct radiation under covering of non-woven polypropylene, insect-net and no covering treatment gave boost to photosynthesis activity also. Low light intensity and diffused light inside low tunnel having covering of polythene sheet may also be responsible for internodal elongation resulting in more vine length as reported by Khapte *et al*. (2021) and Dingal *et al*. (2018) in cucumber. Additionally, at high air temperature around the plant, the root development activity might lead to efficient attainment of water and nutrients in treatment combination of S_1C_1. Further, relatively lower radiation intensity in covering of polythene sheet might have resulted in more leaf area, thereby providing more photosynthetic area (Khapte *et al*., 2021).

The promising microclimatic conditions like optimum range of temperature, relative humidity and light intensity was provide under treatment combination of sowing date of 15th December + covering of polythene sheet (S_1C_1). It influenced the watermelon crop at all growth stages as it reproduced through higher plant biomass and subsequently the fruit yield (Siwek and Capecka, 1999). Sari *et al*., (1994) reported that increase in yield under low tunnel was

Table 2. Interaction effect of sowing date and covering material on number of nodes per vine at last harvest, fruit weight (kg), number of fruits per plant and fruit yield per plant (kg)

Treatments	Number of nodes per vine at last harvest			Fruit weight (kg)			Number of fruits per plant			Fruit yield per plant (kg)		
	2020-21	2021-22	Pooled mean	2020-21	2021-22	Pooled mean	2020-21	2021-22	Pooled mean	2020-21	2021-22	Pooled mean
1.S_1C_0	63.33	67.35	65.34	2.13	2.28	2.20	1.85	1.98	1.91	3.87	4.43	4.15
2.S_1C_1	78.38	82.39	80.39	2.87	3.01	2.94	3.63	3.73	3.68	10.33	11.13	10.73
3.S_1C_2	70.18	74.21	72.20	2.56	2.71	2.63	3.23	3.18	3.21	8.21	8.50	8.35
4.S_1C_3	66.27	70.29	68.28	2.41	2.55	2.48	2.37	2.48	2.42	5.65	6.26	5.96
5.S_2C_0	55.98	60.15	58.06	1.97	2.12	2.04	1.60	1.72	1.66	3.09	3.58	3.34
6.S_2C_1	65.24	69.27	67.25	2.58	2.73	2.66	2.97	3.09	3.03	7.57	8.35	7.96
7.S_2C_2	63.75	67.78	65.77	2.44	2.60	2.52	2.53	2.63	2.58	6.09	6.75	6.42
8.S_2C_3	57.72	61.84	59.78	2.29	2.44	2.37	2.02	2.12	2.07	4.56	5.12	4.84
9.S_3C_0	61.06	65.07	63.06	2.02	2.17	2.09	1.72	1.83	1.78	3.41	3.91	3.66
10.S_3C_1	70.48	74.40	72.44	2.72	2.85	2.78	3.25	3.36	3.30	8.72	9.48	9.10
11.S_3C_2	68.18	72.20	70.19	2.52	2.68	2.60	2.82	2.96	2.89	7.07	7.87	7.47
12.S_3C_3	64.12	68.14	66.13	2.34	2.49	2.42	2.17	2.29	2.23	5.07	5.70	5.39
SEm±	0.08	0.16	0.07	0.002	0.006	0.003	0.01	0.02	0.01	0.04	0.03	0.02
CD@5%	**0.23**	**0.45**	**0.20**	**0.006**	**0.018**	**0.008**	**0.04**	**0.06**	**0.03**	**0.10**	**0.09**	**0.06**

due to increase in harvesting span in cucumber. The maximum fruit yield in S_1C_1 over the other treatment combinations of sowing time and covering material non-woven, insect-net and no covering were attributed due to higher fruit weight, number of fruits per plant. Similar, result was found by Kumar *et al*. (2018) in bottle gourd. The result has also similarities with Pimpini *et al*. (1987) in table tomatoes grown under greenhouse.

References

Butler, B.R. and Ross, D.S. 2009. *Extending the production season for vegetables and small fruits*, College of Agriculture and Natural Resources, University of Maryland, 1-5.

Carlen, C. and Kruger, E. 2009. Berry production in changing climate condition and cultivation systems: Further research requirements. *Acta Horticulturae.* 838: 225-228.

Dingal, D.K., Patil, S.S., Birada, M.S. and Mantur, S.M. 2018. Influence of different protected conditions on growth and yield of parthenocarpic cucumber (*Cucumis sativus*) hybrids. *Int J Curr. Microbiol Appl Sci.* 7(5) : 1619-1624.

Khapte, P.S., Meena, H.M., Kumari, P., Burman, U., Saxena, A. and Kumar, P. 2021. Influence of different protected cultivation structures on performance of cucumber (*Cucumis sativus* L.) in Indian hot arid region. *Journal of Agrometeorology.* 23(3) : 265-271.

Kumar, S., Kumar, A., Singh, S.S., Prasad, R. and Kant, S. 2018. Effect of plastic low tunnel on flowering and fruiting behaviour during off season of bottle gourd [*Lagenaria siceraria* (Mol.) Stand]. *Int J CurrMicrobiol Appl Sci.* 7 : 4829-4835.

Pimpini, F., Granguinto, G., Babbo, G. and Xodo, E. 1987. The effectof protective structures and of pinching on the earliness of tabletomatoes in the greenhouse. *Prottte.* 16(8/9) : 63-73.

Rajkumar, R., Marimuthu, S. and Muraleedharan, N. 2002. Photosynthetic efficiency of sun and shadegrown tea plants. *Sri Lanka J. Tea Sci.* 67 : 67–75.

Samanta, M. and Hazra, P. 2019. Microclimate suitability for green and coloured sweet pepper hybrids in open and protected structures in sub-tropical humid climate of West Bengal. *J. Agrometeorol.* 21(1) : 12-17.

Sari, N., Guler, H.Y., Abak, K., Pakyurek, Y., Babik, I. and Rumpel, J. 1994. Effect of mulch and tunnel on the yield and harvesting period of cucumber and squash. 7th International symposium on timing field production of vegetables, Skierniewice, Poland, 23-27 August 1993. *Acta Horticulturae.* 371 : 305-310.

Singh, R.K. and Satpathy, K.K. 2005. Scope and adoption of plastic culture technology in north east hill region. *In: Agricultural mechanisation in North East India, ICAR, Research Complex for NEH region, Barapani.* 114-21.

Siwek, P. and Capecka, E. 1999. Yielding and fruit quality of some parthenocarpic cucumber cultivars grown under direct cover and low tunnel production. *Folia Horticulturae.* 11 : 33-42.

Smith, I.E., Savage, M.J. and Mills, P. 1984. Shading effects on greenhouse tomatoes and cucumbers. *Acta Hort.* 148 : 491-500.

Smitha, K. and Sunil, K.M. 2016. Influence of growing environment on growth characters of cucumber (*Cucumis sativus*). *J Trop Agric.* 54(2) : 201-203.

Witter, S.H. and Honma, S. 1979. Greenhouse Tomatoes, Lettuce and Cucumbers. *East Lansing, Michiga University Press*.