

DOI No.: <http://doi.org/10.53550/EEC.2024.v30i02s.028>

Varietal Effect on Plant Growth and Soil Moisture Content of Cabbage under Drip Irrigation Levels

Bhagchand Yadav¹, P.K. Yadav², Sheetal Rawat and Sunil Kumar Sharma¹

Department of Horticulture, College of Agriculture, SKRAU, Bikaner 334 006, Rajasthan, India

(Received 1 July, 2023; Accepted 6 September, 2023)

ABSTRACT

An experiment was conducted for two *Rabi* seasons of year 2021-22 and 2022-23 on four irrigation levels (60 per cent, 80 per cent, 100 per cent and 120 per cent PE) and four varieties of cabbage (Golden Acre, Pusa Mukta, Pusa Cabbage -1 and Pusa Cabbage Hybrid-81) at College of Agriculture, SKRAU, Bikaner. The experiment was laid out in split plot design with three replications. Results showed that irrigation at 100 per cent PE was recorded significantly increased plant height (26.15, 25.66 and 25.91 cm) over 60 per cent and 80 per cent PE. The weight of head with unfolded leaves (1179.06, 1161.40 and 1170.23 g plant⁻¹) and soil moisture content at 60 DAT (11.63, 11.30 and 11.46 per cent) were recorded significantly higher with 120 per cent PE over 60, 80 and 100 per cent PE irrigation levels in 2021-22 and 2022-23 and pooled mean basis, respectively. Among the varieties, plant height (25.62 cm) was recorded significantly higher with Pusa Mukta over the Pusa Cabbage -1 and Pusa Cabbage Hybrid -81 during both the years and pooled mean basis. The significantly maximum weight of head with unfolded leaves (940.65 g plant⁻¹) was recorded under the variety of Pusa Mukta compared to other varieties on pooled mean basis. Soil moisture content was not significantly affected with different cabbage varieties during both the experimental years.

Key words: Pan evaporation, Irrigation and Cole Crops

Introduction

Cabbage (*Brassica oleracea* var. *capitata* L.) is a member of Brassicaceae or Cruciferae family and a useful vegetable. The edible part, head is formed by thickening of edible bud with tightly packed overlapping leaves. In cabbage, due to presence of Indol-3 carbinol, it protects against cancer. Cabbage head juice is also used as a remedy against poisonous mushroom. The area under the vegetable cultivations in India is 10.96 million hectare with production of 197.23 million ton and the area of cabbage in India is 415 thousand hectare with production of 9567 thousand ton. Major cabbage growing states are West Bengal, Orissa, Madhya Pradesh, Bihar, Assam, Gujarat, Chhattisgarh, Jharkhand, Uttar

Pradesh, Karnataka, Maharashtra and Rajasthan (Anonymous, 2022).

Water is the most important factor in successful production of crops. In arid regions, limited availability of irrigation water enforced the idea of its efficient use of irrigation water. In the country, Rajasthan faces one of the greatest scarcities of water resources. Rajasthan a state with about 10% of land area has only around 1% of the country's water resources. Under such circumstances, micro-irrigation, an efficient approach for irrigation water management has played a most significant role to bring more area under irrigation with the available water and increasing the productivity of crop and water use efficiency (Sivanappan, 2004). Drip irrigation helps in maintain the optimum soil moisture in root

(¹Research Scholar, ²Professor & Head)

zone of plants and with increased water use efficiency as well as yield of crop. Variety is an important factor for successful crop yield. An improved variety signify higher yield than wild one. A number of varieties of cabbage are available for different environment with specific habit and characteristics. The increase in production is achieved through use of high yielding varieties of cabbage such as Golden Acre, Pusa Mukta, Pusa Cabbage-1 and Pusa Cabbage Hybrid-81.

Materials and Methods

The field experiment was conducted at Instructional Farm, College of Agriculture, SKRAU, Bikaner during *Rabi* season of 2021-22 and 2022-23. Bikaner is situated at 28° 01'N latitude and 73° 22'E longitude at an altitude of 234.70 meters above Mean Sea Level. As per NARP, Bikaner falls in Agro climatic zone IC (Hyper Arid Partially Irrigated North Western Plain Zone). The treatment comprising of four irrigation levels (60, 80, 100 and 120 per cent PE) in main plots and four varieties (Golden Acre, Pusa Mukta, Pusa Cabbage -1 and Pusa Cabbage Hybrid -81) in sub plots. The experiment was laid out in split plot design with three replications.

Drip irrigation was given to experimental fields on the basis of pan evaporation (PE) by the prevailing atmospheric conditions recorded daily from Agro-Meteorological observatory, ARS, Beechwal, Bikaner. Five weeks old seedlings of the crop having

average height of about 10-15 cm were transplanted in evening at 45 x 30 cm row to row and plant to plant spacing, respectively.

Results and Discussion

The significant maximum plant height with irrigation levels at 100 per cent PE (26.15, 25.66 and 25.91 cm) as compared to 80 per cent PE and 60 per cent PE level in 2021-22, 2022-23 and pooled mean basis, respectively (Table 1). In case of 60 per cent and 80 per cent PE, the plant growth less due to water deficit condition in plant tissue resulting in decline of leaf water content as well as reduction in both cell turgor and cell volume. The results are conformity with the findings of Thentu *et al.* (2016) in broccoli and Khan *et al.* (2018) in cauliflower. It is clear from the data presented in table 3.1 that cabbage varieties significant increase in plant height at 60 DAT. Significantly higher plant height recorded with Pusa Mukta (25.73, 25.51 and 25.62 cm) as compared to Pusa Cabbage- 1 and Pusa Cabbage Hybrid- 81 in 2021-22, 2022-23 and pooled mean basis, respectively. This might be due to the genetic and environment variations among the varieties used in the present study. The varietal effect on growth of plants was supported by Mishra *et al.* (2022) in cabbage.

The application of 120 per cent PE irrigation level significantly obtained highest weight of head with unfolded leaves (1179.06, 1161.40 and 1170.23 g

Table 1. Effect of irrigation levels and response of cabbage varieties on plant height, weight of head with unfolded leaves and soil moisture content

Treatments	Plant height (cm) at 60 DAT			Weight of head with unfolded leaves (g plant ⁻¹)			Soil moisture content (%) at 60 DAT		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
Irrigation levels									
60% PE	20.44	19.62	20.03	525.94	511.08	518.51	9.14	9.05	9.10
80% PE	23.69	23.28	23.49	839.34	828.02	833.68	10.64	10.20	10.42
100% PE	26.15	25.66	25.91	1058.02	1040.11	1049.06	11.07	10.85	10.96
120% PE	26.39	25.92	26.16	1179.06	1161.40	1170.23	11.63	11.30	11.46
S.Em.±	0.69	0.65	0.47	15.25	15.49	10.87	0.10	0.11	0.07
CD (P=0.05)	2.40	2.25	1.46	52.76	53.61	33.49	0.35	0.38	0.23
Varieties									
Golden Acre	25.14	24.29	24.72	923.59	909.04	916.31	10.70	10.28	10.49
Pusa Mukta	25.73	25.51	25.62	949.38	931.92	940.65	10.67	10.35	10.51
Pusa Cabbage – 1	23.68	23.24	23.46	908.39	893.51	900.95	10.68	10.38	10.53
Pusa Cabbage Hybrid - 81	22.11	21.45	21.78	821.00	806.14	813.57	10.44	10.39	10.41
S.Em.±	0.67	0.62	0.46	7.96	7.69	5.53	0.09	0.12	0.08
CD (P=0.05)	1.95	1.82	1.30	23.23	22.44	15.73	NS	NS	NS

plant¹) as compared to other irrigation levels during 2021-22, 2022-23 and in pooled mean basis, respectively. Similar findings also reported by Xu and Leskovar (2014) in cabbage and Kumari *et al.* (2018). The Pusa Mukta produced significantly maximum weight of head with unfolded leaves (949.38, 931.92 and 940.65 g plant¹) which were higher over other varieties. It might be due to high net photosynthesis rate and carboxylation efficiency was recorded with Pusa Mukta which ultimately resulted into higher production. Similar findings were observed by Kumari (2023).

The moisture content of soil was significantly increased with increase levels of drip irrigation. The significantly highest moisture content in soil was recorded with 120 per cent PE level at 60 DAT (11.63, 11.30 and 11.46 per cent) during both the years of 2021-22, 2022-23 and in pooled mean basis, respectively. This might be because of the application of water is already high with 120 per cent PE irrigation level and the plant growth with these treatments were vigorous which decreased the evaporation of water from soil that resulted into higher soil moisture content in soil. The similar results were noted by Hallikeri (2008) and Faloye *et al.* (2015). The content of soil moisture has non significant effect with the different varieties of cabbage during both experimental years.

Conclusion

The treatment 100 per cent PE irrigation level was found to be significantly superior for plant growth. However, significantly maximum weight of head with unfolded leaves and soil moisture content were recorded under 120 per cent PE irrigation level. The significantly maximum plant height, weight of head with unfolded leaves and soil moisture content were recorded under Pusa Mukta.

References

- Anonymous, 2022. *Agricultural Research Data Book, 2022*, ICAR- Indian Agricultural Statistics Research Institute, Pusa, New Delhi. Pp. 163.
- Faloye, O.T., Ojo, A.S. and Fasanu, O. 2015. Effect of irrigation on growth of cowpea at different developmental stages and water use efficiency. *Swift Journal of Agricultural Research*. 2(1): 001-011.
- Hallikeri, S. S. 2008. *Effect of sowing time, nitrogen and irrigation levels on yield, fibre quality and cry protein concentration in Bt. Cotton*. Ph.D. Thesis, University of Agricultural Sciences, Dharwad, Karnataka.
- Khan, S., Khan, N., Ullah, Z., Ahmad, J., Khan, A., Nawaz, F. and Khan, K. 2018. Effect of deficit irrigation and nitrogen levels on growth and yield of cauliflower under drip irrigation. *Pure and Applied Biology*. 7(2): 910-921.
- Kumari, A., Patel, N. and Mishra, A.K. 2018. Response of drip irrigated broccoli (*Brassica oleracea var. italica*) in different irrigation levels and frequencies at field level. *Journal of Applied and Natural Science*. 10(1): 12-16.
- Kumari, L. 2023. *Effect of irrigation levels on growth, yield and quality of cowpea (Vigna unguiculata L. Walp) varieties grown under drip system*. Ph.D. Thesis, Swami Keshwanand Rajasthan Agricultural University, Bikaner.
- Mishra, P., Kumar, S., Yadav, S., Anushruti and Shukla, U. 2022. Effect of different varieties and spacings on growth and yield attributes of cabbage (*Brassica oleracea var. capitata* L.) under Lucknow conditions. *The Pharma Innovation Journal*. 11(3): 1174-1178.
- Sivanappan, K. 2004. Irrigation and rainwater management for improving water use efficiency and production in cotton crop. In: *Proceeding of International Symposium on strategies cotton production: A Global Vision* held, during 23-25 November 2004 at University of Agriculture Sciences, Dharwad, Karnataka.
- Thentu, T. L., Dutta, D., Mudi, D.D. and Saha, A. 2016. Performance of broccoli (*Brassica oleracea var. italica*) under drip irrigation and mulch. *Journal of Applied and Natural Science*. 8(3): 1410-1415.
- Xu, C. and Leskovar, D.I. 2014. Growth, physiology and yield responses of cabbage to deficit irrigation. *Horticulture Science (Prague)*. 41(3): 138-146.