Annals of Plant and Soil Research 23 (4):515-518 (2021)
https://doi.org/10.47815/apsr.2021.10112

Impact of FYM and gypsum on seed yield and seed quality of carrot (*Daucus carota* L.) under high RSC water

AMIT KUMAR*, VINOD KUMAR BATRA, VIJAYPAL SINGH PANGHAL, ARCHANA AND AXAY BHUKER[1]

Department of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004 (India)

Received: August, 2021; Revised accepted: September, 2021

ABSTRACT

The study was carried out to find out the effect of high RSC water, FYM and gypsum on seed yield and seed quality parameters of carrot (Daucus carota L.) at CCS HAU, Hisar during rabi season of 2015-17. The cultivar used for the investigation was Hisar Gairic. The treatments comprising three levels of FYM (0, 10 and 20 t ha^{-1}) and gypsum (0, 50 and 100% neutralization of RSC) and its combinations were laid out in a factorial randomized block design with three replications. The minimum values for seed yield (1.3 q ha^{-1}), test weight (2.3 g), standard germination (72.3%), vigour index I (1129) and vigour index II (690) were recorded in control (F_0G_0). The maximum values for seed yield and seed quality parameters were recorded with combination of 20 t FYM ha^{-1} and 100% neutralization of RSC by gypsum. The combination of 20 t FYM ha^{-1} and 100% neutralization of RSC by gypsum proved the best treatment in carrot for quality seed production at commercial scale under semi-arid condition of Hisar (Haryana).

Keywords: Carrot, FYM, gypsum, yield, seed quality, RSC water

INTRODUCTION

Carrot (*Daucus carota* L.) is a popular cool season vegetable grown for its root. It is cultivated in temperate countries during spring and summer season, while in tropical region during the winter season. Carrots are classified into two groups of varieties viz., the European type, which are biennial and Asiatic type being annual. The Asiatic types produce seed in the plains while the European type produce seed in hilly areas in India. The seed is the basic and most important input and has profound impact on the ultimate yield of the crops. In carrot crop, the demand for quality seed especially of Asiatic type is not only within the country but there are huge possibilities of export to other countries in tropical and sub-tropical regions where commercially seed is not produced.The area of carrot is increasing day by day every year and accordingly its demand for quality seed is also increasing faster.

In Haryana state on an average, 55% of ground water is of poor quality. The production of vegetable crops is threatened by inadequate quality water, increasing soil salinity or alkalinity particularly in irrigated areas. A significant decrease in ability to germinate with the increase in electric conductivity (ECw) of water is common phenomenon and increasing level of salinity caused a marked reduction in germination percentage and fresh and dry biomass of seedlings of various vegetable crops like turnip and radish cultivars (Noreen and Muhammad, 2008). Application of ammendments like FYM in carrot significantly affects the quality charactersitics (Kumari *et al.* 2009). Kumar (2014) also reported that highest seed weight per umbel, maximum diameter of umbel, highest seed weight per umbel, the highest seed yield per plot, maximum 1000-seed weight and maximum vigour index were observed with the application of 5 t vermicompost ha^{-1} while the lowest values of these parameters were observed in control plots. Tripathi *et al.* (2013) found that the application of 50% RDF+ 5t FYM ha^{-1}+PSB @ 2.5 kg ha^{-1} recorded maximum test weight over other treatments. Application of gypsum in conjunction with FYM also affects the seed yield and quality parameters of crops particularly the vegetable crops (Choudhary 2020). Therefore, keeping in view of the importance of carrot crop, its seed demand and the availability of poor quality ground water for irrigation, the present investigation was carried out.

MATERIALS AND METHODS

The present study was conducted at the vegetable Research farm, CCS Haryana Agricultural University, Hisa over a period of two years (2015-16 and 2016-17). The experimental site is located at 29^0-10' North latitude and 75^0-46' longitude at the mean elevation of 215.2 meter. The soil of the experimental field was sandy loam Typicustochrept having 19.6% clay and CEC 9.3 c mol kg^{-1} in 0-30 cm layer. The soil pH ranged between (7.6 and 9.6) and ESP values had a wide variation (12.9 to 43.5) among the plots with and without gypsum. The experimental treatments were laid out in randomized block design with three replications having three levels of FYM and gypsum each. The total seed yield of main, first order and second order umbels from all the plants were recorded. Test weight of seed was recorded at maturity. Standard germination was conducted by taking One hundred seeds from each treatment were placed on the top of the paper for germination test and replicated thrice. These petri dishes were placed in germinator at 20 ^oC with 90-95 per cent relative humidity and final germination count was made after 14 days of sowing. The number of normal seedlings in each replication were counted and later converted into seed germination percentage. Vigour index I was estimated by seedling length (shoot length + root length) was measured and seed vigour index was calculated by multiplying seedling length to germination percent. Vigour index II was estimated by seedling dry weight (g) was measured and seed vigour index was calculated by multiplying seedling dry weight (g) to germination percent. Statistical analysis of data collected during the study was done by applying the technique of analysis of variance (ANOVA) as suggested by Gomez and Gomez (1984). All the statistical analy-sis was carried out by using OPSTAT statistical software.

RESULTS AND DISCUSSION

Germination and Test weight

The standard germination % of seeds of different order umbels as well as main umbel was greatly affected by the sodicity. Minimum standard germination (72.3, 69.7 and 57 %) of seeds was observed in control and maximum (83.1, 78.0 and 68.4%) in different orders umbels with the application of 20 t FYM ha^{-1} and 100% neutralization of RSC (Table 1). The reason behind this is sodicity stress and high pH environment caused by sodicity which resulted in ions imbalance, metabolic disorders, and also destroys the structure and function of root cells (Shi and Wang, 2005). The standard germination per cent was increased with the increasing levels of FYM and gypsum. Noreen and Muhammad (2008) and Isabel *et al.* (2015) in radish observed the similar results. The test weight of seed of main umbel as well as various orders umbel was significantly influenced by the various levels of FYM and gypsum. Maximum test weight (3.0, 2.7 and 1.8 g) was observed in the F_2G_2 treatment receiving combination of 20 t FYM ha^{-1} and 100% neutralization of RSC, while the minimum test weight (2.3, 2.1 & 1.5 g) was in control (Table 1). This is due to the fact that gypsum and FYM improved vegetative and

Table 1: Effect of high RSC water, FYM and gypsum on Standard germination (%) and test weight (g) of different order umbels

FYM	Main umbel				First order umbel				Second order umbel			
	G_0	G_1	G_2	Mean	G_0	G_1	G_2	Mean	G_0	G_1	G_2	Mean
Standard germination (%)												
F_0	72.3	74.4	76.1	74.3	69.7	71.5	73.1	71.4	57.0	59.0	62.9	59.6
F_1	73.5	77.4	79.6	76.8	70.2	73.7	75.5	73.1	58.1	63.6	64.8	62.2
F_2	74.0	81.0	83.1	79.4	71.4	76.2	78.0	75.2	58.6	66.8	68.4	64.6
Mean	73.3	77.6	79.6		70.4	73.8	75.6		57.9	63.2	65.4	
(P=0.05)	G = 0.55,F= 0.55,G x F= 0.95				G = 0.31,F= 0.31,G x F= 0.57				G = 0.48,F= 0.48,G x F= 0.84			
Test weight (g)												
F_0	2.3	2.4	2.6	2.4	2.1	2.3	2.3	2.3	1.5	1.5	1.6	1.5
F_1	2.3	2.6	2.7	2.5	2.2	2.4	2.5	2.4	1.5	1.7	1.7	1.6
F_2	2.4	2.9	3.0	2.7	2.3	2.6	2.7	2.5	1.6	1.8	1.8	1.7
Mean	2.3	2.6	2.7		2.2	2.4	2.5		1.5	1.6	1.7	
(P=0.05)	G = 0.03,F= 0.03,G x F= 0.06				G = 0.04,F= 0.04,G x F= 0.06				G = 0.07,F= 0.07,G x F= NS			

reproductive growth of carrot seedlings under sodic water conditions. With improvement in vegetative growth, the photosynthetic process could have been improved which resulted in heavier seeds. The better growth of carrot seedlings caused by gypsum and FYM may be attributed to increased nutrient availability and improved soil physical, chemical and biological properties under alkali soil conditions. The interaction effect of FYM and gypsum also influenced the test weight of various umbels. The Similar findings were observed by Bilekudari *et al.* (2005) in radish and Tripathi *et al.* (2013) in coriander**.**

Vigour index

An important attribute of seed quality i.e. vigour index which improved significantly (in each order umbel) with increased levels of FYM and gypsum. Maximum vigour index I (1706, 1481 and 1202) and vigour index II (1101, 953 and 746) was recorded when the crop was treated with 20 t FYM ha^{-1} and RSC was 100% neutralized and minimum (1129, 1018 and 781) and (690, 607 and 488) with no FYM and gypsum treatment (Table 2). Because the neutralized water enhanced the plant growth parameters and also important constitute for quality seed, ultimately enhanced the seed vigour. Similar findings were observed by Kumari *et al.* (2009) in carrot, Choudhary (2020) in radish.

Table 2: Effect of high RSC water, FYM and gypsum on vigour index I and II of different order umbels

FYM	Main umbel				First order umbel				Second order umbel			
	G_0	G_1	G_2	Mean	G_0	G_1	G_2	Mean	G_0	G_1	G_2	Mean
Vigour index I												
F_0	1129	1193	1272	1198	1018	1102	1217	1112	781	891	1014	895
F_1	1181	1377	1524	1361	1150	1333	1415	1299	903	1032	1067	1000
F_2	1215	1584	1706	1502	1172	1417	1481	1357	916	1135	1202	1084
Mean	1175	1385	1501		1113	1284	1371		867	1019	1094	
(P=0.05)	G=6.07, F=6.07, Gx F= 10.52				G = 6.96, F= 6.96,G x F= 12.06				G = 5.53,F= 5.53,G x F= 9.57			
Vigour index II												
F_0	690	766	850	769	607	703	789	700	488	535	599	541
F_1	747	890	910	849	685	789	830	768	506	648	662	605
F_2	788	1007	1101	965	747	896	953	865	569	708	746	674
Mean	742	888	954		680	796	857		521	630	669	
(P=0.05)	G= 7.53,F=7.53,G x F= 13.03				G = 6.47,F= 6.47,G x F= 11.21				G = 6.10,F= 6.10,G x F= 10.57			

Seed yield

The minimum seed yield (1.3 q ha^{-1}) was observed in control (F_0G_0) and maximum (5.5 q ha^{-1}) in (F_2G_2) treatment where 100% neutralization of RSC water (Table 1). This might be due to the fact that the gypsum had neutralized the sodicity effect of water. The farmyard manure seems to act directly by increasing the crop yield either by accelerating the respiratory process through cell permeability or by hormone growth action. It supplies nitrogen, phosphorus and sulphur in available forms to the plants through biological decomposition.

Table 3: Effect of high RSC water, FYM and gypsum on total seed yield q ha^{-1}

FYM	(2015-16)				(2016-17)				Pooled			
	G_0	G_1	G_2	Mean	G_0	G_1	G_2	Mean	G_0	G_1	G_2	Mean
F_0	1.2	1.9	2.6	1.9	1.3	2.0	2.7	2.0	1.3	2.0	2.7	2.0
F_1	1.7	3.3	4.1	3.0	1.8	3.3	4.2	3.1	1.7	3.3	4.1	3.1
F_2	2.2	4.5	5.5	4.1	2.2	4.6	5.5	4.1	2.2	4.5	5.5	4.1
Mean	1.7	3.2	4.1		1.8	3.3	4.1		1.8	3.3	4.1	
(P=0.05)	G =0.10,F= 0.10,G x F= 0.17				G =0.12,F= 0.12,G x F= 0.20				G =0.20,F= 0.20,G x F= 0.34			

G= Gypsum, F= FYM

Indirectly, it improves the nutrient uptake as well as physical properties of soil such as aggregation, aeration, permeability and water holding capacity. The seed yield with gypsum as well as FYM application showed a significant increasing trend. Singh *et al.* (2008) in bottle gourd, Kaswan *et al.* (2013) in onion, Vithwel and Kanaujia (2013) in carrot also observed the similar effect of gypsum and FYM.

From the present investigation, it may be concluded that the seed yield and seed quality of carrot in terms of test weight, standard germination (%), vigour index proved better with the application of 20 t FYM ha^{-1} and 100% neutralization of RSC. Therefore, it may be recommended that for quality seed production of carrot crop under high RSC water condition application of FYM and gypsum neutralization will be helpful.

REFERENCES

Bilekudari, M.K., Deshpande, V.K. and Shekhargouda, M. (2005) Effect of sapcing and fertilizer on growth, seed yield and quality of radish. *Karnataka Journal of Agriculture Science* **18**(2): 338-342.

Chaudhary D. (2020) Effect of high RSC water application along with FYM and gypsum on seed production of radish (*Raphanus sativus* L.). Ph.D. Thesis, Department of Vegetable Science, CCS HAU, Hisar, Haryana, India.

Gomez, K.A. and Gomez, A.A. (1984) *Statistical Procedure for Agricultural Research*, 2nd ed. John Wiley and Sons, New York, USA.

Howe, J.A., Florence, R.J., Harris, G., Santen, E., Beasley, J.P., Bostick, J.P. and Balkcom, K.B. (2012) Effect of cultivar, irrigation, and soil calcium on runner peanut response to gypsum. *Agronomy Journal* **104**(5): 1312-1320.

Isabel, S.C., Lobo, C., Hernandez, R., Varaldo,P. and Hector, M. (2015) Remediation of saline soils by a two-step process: Washing and amendment with sludge. *Geoderma* **247**: 140-150.

Kaswan, P.K., Yadav, P.K. and Sharma, B.D. (2013) Response of Onion (*Allium cepa* L.) varieties to farm yard manure in arid region of western Rajasthan. *Annals of Horticulture* **6**(1): 30-34.

Kumar, P., Meghwal, P.R. and Painuli, D.K. (2014) Effect of organic and inorganic nutrient sources on soil health and quality of carrot. *Indian Journal of Horticulture* **71**(2): 222-226.

Kumari, B.V., Yadav, R.H. and Sowmya, M. (2009) A study on the effect of few eco-friendly manures on the growth attributes of carrot (*Daucus carota* L.) *Journal of Environmental Science and Engineering* **51**(1):13-6.

Noreen, Z. and Muhammad, A. (2008) Inter and intra specific variation for salt tolerance in turnip (*Brassica rapa* L.) and radish (*Raphanus sativus* L.) at the initial growth stages. *Pakistan Journal of Botany* **40**(1): 229-236.

Shi, D.C. and Wang, D.L., (2005) Effects of various salt–alkali mixed stresses on Aneurolepidium chinense (Trin.) Kitag. *Plant Soil* 271:15-26.

Singh, A., Yadav, A.C., Brar, J.S., Sharma, S.K., and Phogat, V., (2008) Effect of FYM and gypsum on production of bottle gourd under sodic water conditions. *Haryana Journal Horticulture Science* **37**(3/4): 297-298.

Tripathi, M.L., Singh, H. and Chouhan, S.V.S. (2013) Response of coriander (*Cariandrum sativum* L.) to integrated nutrient management. *International Journal of advanced Multidisciplinary Research* **2**(2):43-46.

Vithwal and Kanaujia, S.P. (2013) Integrated nutrient management on productivity of carrot and fertility of soil. *SAARC Journal of Agriculture* **11**(2): 173-181.