International J. Seed Spices 11(1), January 2021:9-14

Effect of Foliar Application and Seed Treatment of Decomposer on Growth and Yield of Cumin *(Cuminum Cyminum L.)* under Saline Condition

Kamla K. Choudhary*, R.S. Mehta, A.K. Shukla and S.R. Meena

ICAR-Central Arid Zone Research Institute, Regional Research Station, Pali, Marwar 306 401 (Rajasthan)

Abstract

Cumin (*Cuminum cyminum L.*) is one of the most valuable *rabi* crop specially for the arid region farmers but crop faced many challenges in production is affected by diseases and pest, poor quality of irrigation water and climatic conditions which are responsible for heavy yield losses. A field study carried out at main research farm of CAZRI-RRS, Pali district (Rajasthan), during *rabi* 2017 and 2018 to evaluate the appropriate timing of foliar spray and seed treatment of decomposer on growth, disease and pest incidence and yield of cumin under saline condition. The experiments were conducted in RBD design with three replications. Groundwater was used for irrigation throughout the experiment with water quality (ECiw>4.6dSm^{-1}). T_5 treatment showed significant effect on seed germination, plant height, number of seed umbelle^{-1}, number of umbellets umbel^{-1} and 1000 seed weight on the basis of pooled data of 2017 and 2018 but no significant effect on secondary branch of plant and number of umbel plant^{-1}. Seed treatment with three foliar spray of decomposer at different stage of plant at 45, 60 and 75 DAS (T_5) produced significantly higher seed yield (581.1kg ha^{-1}) and (659kg ha^{-1}) and straw yield (1129kg ha^{-1}) and (1472kg ha^{-1}) in both the year 2017 and 2018 over the control (T_1) (341kg ha^{-1}) and (419kg ha^{-1}) respectively. The highest net return and BC ratio was recorded under the T_5 (₹ 60834 ha^{-1} and 2.2) followed by T_4 (₹ 56068 ha^{-1} and 2.1) over the control (T_1) (₹ 19431 ha^{-1} and 1.4 respectively). Seed treatment and foliar application of decomposer at 45, 60 and 75 DAS (T_5) exhibited higher yield of cumin being at par with rest of the treatment with decomposer. However, all the treatments of decomposer were superior over the control.

Keywords: Cumin, foliar spray, salinity, seed treatment, yield

Introduction

India has always been renowned as a land of spices and seed spices occupies 46.76 per cent area and 19.77 per cent production of total spices area and production in the country during 2019-20. In India twenty seed spices grown but cumin is a major grown seed spices in an area of 12.76 lakh hectare with production of 9.17 lakh tonnes having productivity of 715 kgha^{-1}. In India cumin is mainly grown in Rajasthan and Gujarat. In Rajasthan cumin is grown in 7.79 lakh hectare areas with production of 4.28 lakh tonnes having productivity of 542 kgha^{-1}. In Rajasthan cumin is mainly grown in Jalore, Barmer, Jodhpur,Nagour and Pali districts. Productivity of cumin in Rajasthan is very low compared to national average. Potential yield of improved variety of cumin ranges from 18-20 qha^{-1}. There is large gap between realized yield and potential yield of improved varieties of cumin. Salinity is one of the major limiting factor for crop production. Aishwat *et al.,* (2011) reported that cumin is fairly tolerant to higher pH and in most of cumin growing area underground water is saline in nature. Dayal *et al.,* (2001) reported increase in suppression of seed germination with increase in salinity level in the tested genotype. In order to protect cumin from incidence of diseases and pest, it is necessary to treat seed and foliar application of decomposer at different stage of plant for improvement in growth of plant and minimum losses of yield. Foliar spray of urea is having the beneficial impact on many vegetables spices in term of increasing yield and improvement of crop quality (Padem and Yildirim, 1996; Kolota and Osinska 2001). Baloch et al., (2019) reported that plant vegetative growth and yield components of wheat crop were significantly affected by different nitrogen foliar application rate along with NPK. Recommended foliar application of nitrogen play a major role in both seed quality and yield (Wilhelm et al., 2002). Cumin is very much sensitive crop with changes in weather condition and very much susceptible to blight and wilt disease if relative humidity is more in vicinity of crop. There for study on application of different treatments of decomposer on cumin crop for realising higher yield and profitability was undertaken.

*Corresponding author email: kamla.skn04@gmail.com

Material and methods

Experiment area and climatic condition

A field experiment was conducted at main research farm of CAZRI, RRS, Pali-Marwar, for two years during winter rabi-season of 2017-18 and 2018-19 for evaluating the effect of foliar spray and seed treatments of decomposer (the formulation from National Centre for Organic Farming, Department of Agriculture, Cooperation and Farmers Welfare, Govt. of India) on growth, disease, pest incidence and yield of wheat. The experimental site is located at about Latitude 25° 80' 079" N, Longitude 73° 29' 57" E & Altitude 222m, Zone-IIB transitional plan of luni basin. Soil sample were collected from experimental field at 0-15 and 15-30cm soil depth. The soil was sandy loam, having 30–45 cm soil depth. EC of soil 1.91 (dSm^{-1}) and pH range between 7.5-8.6, organic carbon 0.34%, BD 1.40 gcm^2, available Nitrogen, Phosphorous and Potassium was 195.2 kg ha^{-1}, 15.2 kg ha^{-1} and 251.3 kg ha^{-1} respectively. Supplied of irrigation water with EC>4.6 (dSm^{-1}) and pH 8.2.

Experiment Design and treatments

The experiment was laid in three replications in RBD design with plot size 3mx3m ($9m^2$). Details of treatments given in (Table 1). Cumin GC-4 variety was taken for the study. Before sowing the cumin seeds was treated with decomposer and left for dry in shades for half an hour. The cumin seeds were sown by hand in both year on 25th November 2017 and 28th November 2018 at row spacing of 22cm and pre-sowing, nitrogen (30 kg ha^{-1}) and phosphorus (40 kg ha^{-1}) was applied all plots. Ratio of decomposer for spray on crop was kept 1:10 (1 liter decomposer: 10 liter water). The quality of irrigation water was (ECiw>4.6dSm^{-1}& pH 8.2). Weeding was done in crop 35 days after sowing and 3-4 days after sowing one irrigation was applied for ensuring seed germination for crust braking. Identified the wilt and yellow mosaic disease and counted number of affected plant in each plot of cumin in one meter square ($1m^2$) row area of plot.

Table 1. Treatments details of field experiment

Symbols	Treatments Details
T1	Control
T2	Seed treatment with decomposer
T3	Seed Treatment + One Foliar spray with decomposer at 45 DAS
T4	Seed Treatment + Two Foliar spray with decomposer at 45 and 60DAS
T5	Seed Treatment + Three Foliar spray with decomposer at 45, 60 and 75DAS
T6	One Foliar spray with decomposer at 45 DAS
T7	Two Foliar spray with decomposer at 45 DAS and 60 DAS
T8	Three foliar spray with decomposer at 45, 60 and 75 DAS
T9	Seed treatment with Trichoderma

Recording of growth and yield parameters

Five plants were selected randomly in each plot of replication for recording growth and yield parameters at harvesting stage of crop in both the year 2017 and 2018. Five plants from different treatments were selected for recording observation and analysis was done on the basis of pooled data. The observations *viz:*, Plant height (cm) at maturity stage, 1000 seed weight (g), number of seeds $umbellet^{-1}$, number of umbels $plant^{-1}$, number of umbellets $umbel^{-1}$, number of branch $plant^{-1}$ were recorded.

Statistical Analysis

Statistical analysis was done as per procedure suggested by the Panse and Sukhamate (1985).

Results and discussion

Germination (%)

Seed germination was significantly affected by seed treatment with decomposer under saline condition presented (Fig.1). Treated seed with decomposer performed well under saline condition (EC >4.6dSm^{-1}) during 2017 and 2018 on pooled data basis. Maximum seed germination was recorded in T_5 (90.03%) treatment and being at par with the treatment of T_4, T_2 and T_3 respectively; while the lowest value of germination was found in T_6 (81.2%) followed by T_1 (82.03%) treatment respectively. Salinity may adversely influence seed germination. Rapid seed germination and subsequent seedling establishment are important factors affecting

crop production under salinity conditions. *Basra et al.,* (2006) and Mahmood Shoor *et al.,* (2014) reported that treated seed of crops germinated faster and developed longer seedling compared with untreated seeds. Olfa Baatour, *et al.,* (2009) reported that seed germination and root length as the best indicator of salinity tolerant in plant.

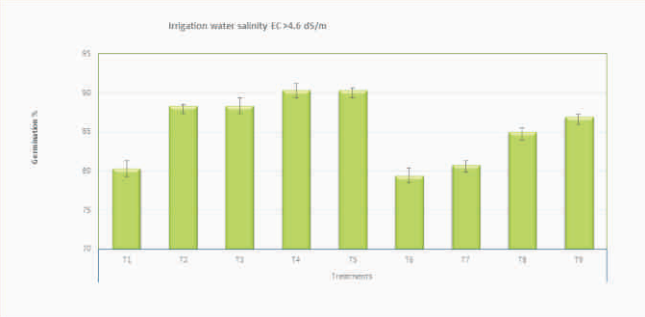

Fig.1. Effect of saline irrigation water on seed germination of cumin

Plant growth and yield attributes

The effect of seed treatments and foliar spray of decomposer at 45, 60 and 75 days after sowing of crop on plant height, number of seeds umble^{-1}, umbel lets plant^{-1} and 1000 seed weight was significant and non-significant effect on secondary branches and number of umbels plant^{-1} was observed on the basis of two year pooled data (2017 and 2018). The analyzed pooled data are presented in Table 2. Seed treatment with three foliar spray of decomposer at different stage of plant at 45, 60 and 75 DAS (T_5) significantly resulted in maximum seed weight (3.13g), number of seeds umbellet^{-1} (25.8) and number of umbellet umble^{-1} (20.83) respectively, while minimum seed weight, number of seeds umbellet^{-1} and number of umbellet umble^{-1} value were obtained in control (T_1) 2.77g, 16.1 and 12.16 followed by T_6 treatments respectively. The average value of the parameters was reported by the rest treatments on pooled basis. The plant height was significantly higher with seed treatments and foliar application of decomposer at 45, 60 and 75 DAS. The maximum plant height of 23.3cm and 28.08cm was recorded under T_5 treatment (ST+3FSD) at 45, 60 & 75 days), followed by T_4 (22.9cm) and (27.2cm) as compared to control (T_1) method (18.6cm) and (24.8cm) in the year of 2017 and 2018, respectively and being at par with the rest treatments of decomposer (T_7, T_8 and T_9) respectively. In secondary branch and number of umbel per plant there was no significant difference ($p>0.05$) between the treatments of two year pooled data. The maximum secondary branches and number of umbels per plant found in the treatment of T_7 (7.94) and T_4 (5.40) followed by T_5 (7.72)) as compared to rest of treatments..Foliar application of nutrients on plant at different stage plays very important role in vegetative growth and developments and also in improving the resistance against disease in plant. Thalooth *et al.,* 2006; and Ali & Mahmoud, 2013 reported that foliar spray of zinc on mungbean significantly increases plant height, Number of branches plant^{-1}, growth parameters as well as yield and yield component respectively. Similarly Kuttimani and Sesan *et al.,* 2020 reported that foliar spray of nutrients are effective at flowering and grain filling stage for efficient utilization by the crop and it also minimized flower dropping and enhanced the yield.

Table 2. Effect of application of decomposer on yield attributes of cumin crop

Treatments	Plant height (cm)	No. of umbellet/ umble^{-1}	No. of seed umbellets^{-1}	No. of umble plant^{-1}	Secondary branch plant^{-1}	1000 seed weight (g)
T_1	21.7	4.77	16.10	10.03	5.55	2.77
T_2	22.4	5.00	18.73	12.70	5.72	2.94
T_3	22.6	5.03	22.53	13.87	5.84	2.90
T_4	23.8	5.40	21.87	15.47	7.33	3.09
T_5	25.7	4.87	25.77	20.83	7.72	3.13
T_6	22.3	4.97	18.60	11.20	6.50	2.77
T_7	23.1	4.63	17.47	13.43	7.94	3.02
T_8	23.4	5.17	20.83	14.73	5.89	3.05
T_9	21.9	4.73	17.40	12.03	5.84	2.81
S.Em±	**0.6**	**0.27**	**1.78**	**2.13**	**0.81**	**0.06**
CD(0.05)	**1.8**	**0.81**	**5.35**	**2.13**	**2.43**	**0.19**

Seed yield

Seed treatment and foliar application of decomposer at different growth stages had significant influence on the seed yield and biological yield of cumin crop (Table 3). Significant difference in seed yield of cumin was observed among the different treatments of decomposer in the both year during 2017 and 2018. Seed treatment with three foliar spray at different stage of plant at 45, 60 and 75 day after sowing (T_5) resulted significantly higher seed yield (581.1 kgha^{-1}) during 2017. This was followed by seed treatment and foliar application of decomposer at 45 and 60 DAS (T_4) and this was on par with (T_8 and T_7) with seed yield of 528.2 and 494.8 kg ha^{-1} during 2017 and , respectively. Significantly the lower yield of 340.7kg ha^{-1} was observed with control (T_1). Seed treatment with three foliar spray at different stage of plant at 45, 60 and 75 day after sowing (T_5) produced significantly the higher seed yield (797 kg ha^{-1}) followed by seed treatment and foliar application of decomposer at 45 and 60 DAS (T_4) 750.4 kg ha^{-1} and three foliar application treatment T_8 (683.3 kg ha^{-1}) this was on par with (T_3 and T_7) with seed yield of 680 and 632.8 kg ha^{-1}, respectively. Significantly lower yield of 508.9kg ha^{-1} and 528.4 was observed with control (T_1) and T_6 respectively, during 2018. This might be due to enhancement of growth attributes characters like plant branches, number of seed, and number of umbels plant^{-1} and also resist to disease by crop. The treatment with high concentration of *Trichoderma* consortium spores promotes phyllosphere colonization and benefits both crop yield and quality. Yildirim *et al.,* (2007) reported that foliar spray of urea fertilizer at different stage produce higher yield in Broccoli. Ali and Mahmoud, 2013 reported that foliar application of salicylic acid 150ppm with 500ppm Zn produces the highest significant seed yield of mungbean. Foliar spray of nitrogen fertilizer on plant in flowering and milky stage caused increasing of grain yield. Foliar application of N in flowering and milky stage resulted increasing of seed yield Zecevic *et al*., 2004.

Table 3. Effect of application of decomposer on yield, net return and BC ratio of cumin

Treatments	Seed yield (Kgha^{-1})		Straw yield (Kgha^{-1})		Harvest Index (%)		Net Return (₹ha^{-1})	B:C ratio
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	Pooled	Pooled
T_1	341	509	796	1136	30.0	30.9	19431	1.4
T_2	423	560	957	1153	30.6	32.7	28262	1.5
T_3	449	680	983	1385	31.3	32.9	40240	1.8
T_4	570	750	1115	1451	33.8	34.1	56068	2.1
T_5	581	797	1129	1472	33.9	35.3	60834	2.2
T_6	436	528	968	1211	31.2	30.4	26690	1.5
T_7	495	632	1006	1406	32.9	31.0	40118	1.8
T_8	528	683	1055	1389	33.4	33.0	47090	1.9
T_9	374	618	855	1375	30.4	31.0	29009	1.5
S.Em±	**26.1**	**17.8**	**32.7**	**25.3**	**1.5**	**0.6**	**1164**	**0.01**
CD(0.05)	**78.1**	**53.5**	**97.9**	**75.8**	**4.5**	**1.8**	**3490**	**0.15**

Straw yield

Foliar application of decomposer at different stage of crop and seed treatment significantly increases the straw yield of cumin crop during both year 2017 and 2018. During the year 2017, the highest straw yield of cumin was recorded 1129.3 kg ha^{-1} under T_5 followed by T_4 (1115.2 kg ha^{-1}) and T_8 (1055.2 2 kg ha^{-1}) as compared to control T_1 (796.3 kg ha^{-1}) respectively (Table 3). During 2018 significantly the higher straw yield of cumin was recorded under T_5 (1471.9 kgha^{-1}) followed by T_4 (1451.0 kgha^{-1}) and T_7 treatments (1406.0 kgha^{-1}) over the treatments of control T_1 (1135.6 kgha^{-1}) respectively. The treatment T_8 (1388.7 kgha^{-1}) was on par with (T_3 and T_9) with seed yield of 1384.7and 1375.0 kgha^{-1}, respectively. Cumin straw yield increase to the 18 and 29.6% over the control which is 796.3 and 1132.6 kg ha^{-1} during the year of 2017 and 2018 respectively. Yassen *et al.,* 2010, Ahmed *et al.,* 2011 and Drocelle *et al.,* 2019 to

reported that foliar spray of nutrient during vegetative growth stage enhanced grain and straw yields. Similar results were reported by Abdul Fattah *et al.,* 2012, that foliar spray of NPK fertilizers it directly impact on maize yield.

Harvest Index

The harvest index was significantly affected by different foliar spray and seed treatments with decomposer at growth stages during 2017 and 2018 in pooled basis (Table. 3). The highest HI was obtained in T_5 (34.6%) treatment followed by T_4 (34.0%) and T_8 (33.0%) over the T_1 (control) 30.4%, respectively.

Economics

The economics of cumin crop cultivation was significantly affected with application of different decomposer treatments during 2017 and 2018 on the basis of pooled data (Table 3). The result showed that maximum net returns (₹ ha^{-1}) and benefit cost ration (BCR) was recorded under the T_5 (₹ 60834ha^{-1} and 2.2) followed by T4 (₹ 56068ha^{-1} and 2.1) and T8 (₹ 47090ha^{-1} and 1.9) treatment in comparison to control T_1 (control) with low net return of (₹ 19431ha^{-1} and 1.4) and benefit cost ratio of 1.4 respectively.

Conclusion

The results revealed that seed treatment and foliar application of decomposer at different growth stages of plant is the most appropriate for cumin growth and yield under saline condition. Seed treatment and foliar application of decomposer at 45, 60 and 75 DAS (T5) significantly improved plant growth and yield traits and enhance seed and net income. Disease and pest incidence were no found in study period during both the year.

Reference

Abdul Fattah, A.A., Selim, E.M., and Awad, E.M. 2012. Response of corn plants (Zea mays) to soil and foliar application of minerals fertilizers under clay soil conditions. *J. Applied Science and Research*, 8(8):4711-4719.

Ahmed, A.G., Tawfik, M.M. and Hassanein, M.S. 2011. Foliar feeding of potassium and urea for maximizing wheat productivity in sandy soil. *Australian J. Basic Applied Science*, 5(5):1197-1203.

Aishwath, O.P and Anwer, M.M. 2011. Natural Resource management through seed spices and aromatic plant: Book of Recent advances in seed spices by Ravindra Babu, Jaiman, R.K, Patel, K.D. and Tikka, S.B.S., 107-118.

Ali, E.A. and Mahmoud, A.M. 2013. Effect of foliar spray by different salicylic acid and zinc concentration on seed yield and yield component of mungbean in sandy soil. *Asian J. Crop Science*, 5(1): 33-40.

Baloch, N., Buriro, M., Jatoi, G.H., Memon, K.A., Khaskheli, M.A., Nahiyoon, S.A., Hou, P. and Li, S. 2019. Effect of foliar application of nitrogen on growth, yield and grain quality parameters of wheat (*Triticum aestivum* L.). *Biocell*, 43(5-1):261-267.

Basra, S.M.A., Afzall., Anwar, S., Anwar, M., Shafq, M. and Majeed, K. 2006. Alleviation of salinity stress by seed invigoration technique in wheat (*Triticum aestivum* L.). *Seed Techinical*, 28:36-46.

Demir Kaya, M., Okcu, G., Atak, M., Cikili, Y., Kolsarici, O. 2006. Seed treatment to overcome salt and drought stress during germination in sunflower (*Helianthus annuus* L.) *J. EUR. Agronomy.*

Dhayal, L.S., Bhargava, S.C., and Jakhar, M.L.J. 2001. Salinity tolerance of cumin (*Cuminum cyminum* L.) genotypes during germination. *J. Spices and Aromatic Crops*. 10(2):145-146 .

Drocelle Nirere, Murthy, K., Lalitha, K.N., Murukannappa, B.S and Murorunkwere, F. 2019. Effect of foliar application of water-soluble fertilizers on growth and yield of maze, *Rwanda J. Agricultural Science*, Vol. 1 No. 1.

Kolota, E. and Osinska, M. 2001. Efficiency of foliar nutrition of field vegetables grown at different nitrogen rates. In: Proc. *IC Environ. Prob. IC Environ. Probl. N-Fert. Acta Hort.*, 563:87-91.

Kuttimani, R. and Velyutham, A. 2011. Foliar application of nutrients enhances the yield attributes and nutrients uptake of green gram. *Agric. Sci. Digest.* 31(3):202-205.

Mahmoodshoor, Afrousheh, M., Rabeie, J. and Validi, M. 2014. The effect of salinity priming o n germination and growth stage of cumin (*Cuminum Cyminum* L.). *Research J. Agriculture and Environment Management,* 3(7): 340-352.

Olfabaatour, R., Kaddour, W., Aidiwannes, M., and Lachaalmarzouk, B. 2009. Salt effects on the growth, mineral nutrition, essential oil yield and composition of marjoram (*Origanum majorana*). *Acta Physiology plant*, 10:0374-4.

Padem, H. and Yildirim, E. 1996. Effect of foliar fertilizer on yield and yield components of summer squash (*Cucurbita Pepo* L.). 1st Egypt-Hung. Horticultural

abstract conference Kafr El-Sheikh, Egypt.

Panse, V.G and Sukhamte, P.V. 1985. Statistical methods for agriculture workers fourth enlarged edition, CAR, Pub, New Delhi.

Sesan, T.E., Oancea, A.O., Stefan, L.M., Manoiu, V.S., Ghiurea, M., Raut, L., Aruxandei, D.C., Toma, A., Savin, S., Bira, A.F., Pomohaci, C.M. and Oancea, F. (2020). Effect of foliar treatments with a tricohderma plant bio stimulated consortium on *passiflora caerulea L*. yield and quality. *Microorganisms*, 8(1):123.

Thalooth, A.T., Tawfik, M.M. and Mohamed, H.M. 2006. A comparative study on the effect of foliar application of zinc, potassium and magnesium on growth, yield and some chemical constitute of mungbean plant grown under water stress conditions. *World J. Agricultural Scienc*e, 2:37-46.

Wihelm, W., McMaster, G., and Harrell, D.M. 2002. Nitrogen and dry matter distribution by culm and leaf position at two stage of vegetative growth in winter wheat. *Agronomy Journal*, 94:1078-1086.

Yassen, A.E., Abou El Nour, A.A and Shedeed, S. 2010. Response of wheat to foliar spray with urea and micronutrients. *J. American Science*. 6(9):14-22.

Yildirim, E., Guvenc, M., Turan, A and Karatas2007. Effect of foliar urea application on quality, growth, mineral, uptake and yield of broccoli (*Oleracea* L.). *Plant Soil environment*, 53(3):120-128.

Zecevic, V., Dokic, D., Knezevic, D. and Micanovic, D. 2004. The influence of nitrogen foliar application on yield and bread making quality parameters of wheat. *Kragujevac J. Science*, 26:85-90.

Received : October 2020; Revised : November 2020; Accepted : December 2020.