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EFFECT OF SEED TREATMENT ON SEED QUALITY ENHANCEMENT IN CORIANDER

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ABSTRACT

An experiment was conducted with 40 seed samples of coriander collected from farmers field at Seed Technology Research, NSP (Crop), Orissa University of Agriculture and Technology, Bhubaneswar to study the quality status in comparision to TL seeds with respect to germination, field emergence and seed health. Germination of seed ranged from 36 to 51 % and almost all the seeds had germination % below the minimum prescribed standardof 65 %. The farmers seeds were found to be less vigorous having seedling length SVI-I (659.3 to 1048.6) and seedling dry weight (SVI-II) as 75.2 to 120.2 as compared to TL seed with 1064.4 and 151.4 respectively. Among seed treating chemicals, Carbendazim recorded maximum germination (72%) , field emergence (61%) and yield (90.5g green plant/m^2), SVI-I (1366) and SVI-II (144) . Seed treatment with biocontrol agents revealed that *Trichoderma vidide* (8g/kg seed) gave highest germination %(71%), field emergence (65%)and yield (90.5 g/m^2), SVI-I(1583),SVI-II (142) and found most effective in enhancing speed of germination (upto 5.32), minimum bacterial infection (18%). Based on the above study, it can be concluded that seed treatment with fungicide Carbendazim @ 3g/Kg is the most effective in enhancing quality of seeds saved by the farmers. But owing to so many problems in view of ecosystem and environment, seed treatment with *Trichoderma viride* @ 8g/Kg seed is found most effective in managing seed infection, seed quality and higher yield

INTRODUCTION

Coriander (*Coriandrum sativum* L.) which belongs to family Apiaceae (Umbelliferae) is an important spice and condiment used as common flavouring substance in Indian curries. It is quite popular for its peculiar sweet fragrance in leaves and fruits and is recognized well as good source of vitamins and minerals (Hnamte *et al.,* 2013). Coriander crop is widely cultivated in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Rajasthan, Karnataka and Uttar Pradesh almost in every season. It is popularly grown in the hilly regions of south India in rainy season and mostly in winter season in Odisha. In India eighty per cent farmers use their own saved seeds for sowing. Seed is the basic input for crop production and availability of quality seed is the key to get quality produce adequately. In absence of adequate supply of quality seeds at planting time farmers save their own seed from previous crop. Good quality seed acts as a catalyst for realizing the potential of all other inputs in any crop. There are many factors that can narrow down the gap between potential and farm level yield. Among them, use of quality seed is the most important one (Ahmad, 2001), as quality seeds ensure better germination as well as better yield. But if the seed is of inferior quality then crop failure is unavoidable. To the farmers for satisfactory crop production, a high quality seed is not only desirable but also satisfactorily required. Various fungal and bacterial pathogens are associated with seed which play important role in reducing seed quality, plant stand and crop yield in field (Sahu and Kar, 2009). The advantage of seed treatment in reducing the germination time and improving emergence uniformity is well established under laboratory conditions (Chavan *et al.*, 2014). However, no information is available in literature on the health and other quality status of coriander seeds saved and used by farmers in the country. The combined use of bio-control agents and chemical pesticides has attracted much attention as a way to obtain synergistic or additive effects in the control of pathogens (Maurya *et al.*, 2008).But owing to so many problems in view of ecosystem and environment, a rapid shift has been made from synthetic products to bio products, which are eco friendly and beneficial. Keeping these aspects in view, the present study was also carried out to find out the effect of various bio-agents on seed quality by minimizing the incidence of seed borne diseases. Treatment of seed with beneficial micro-organisms including fungi and bacteria (species of *Trichoderma, Pseudomonas, Bacillus, Rhizobia* etc.) ameliorates a wide variety of biotic, abiotic, and physiological stresses to seed and seedlings (Mastouri *et al.,* 2010). In the present study an attempt has been made to evaluate the quality status of farmers' saved coriander seed and to explore the possibility of increasing the seed quality by minimizing the incidence of seed borne pathogens

MATERIALS AND METHODS

An experiment was conducted with fourty coriander seed samples collected from the farmers' of different districts of Odisha for two years (2013 & 2014) at Seed Technology Research, NSP (crops), O.U.A.T., Bhubaneswar. About 100g

seeds were collected in sealed polythene bags from each location. A truthfully levelled seed (TLS) of Century Seeds Pvt. Ltd was procured from local market for comparison. Immediately after collection, the samples were tested for moisture content, physical purity, germination (ISTA, 1993 and Pramila *et al.,* 2013), seedling vigour index as SVI-1 and SVI-II basing on seedling length and seedling dry weight, respectively (Abdul-Baki and Anderson, 1973), field emergence and seed health following standard moist blotter method. The results were compared with the minimum seed standard prescribed for the crop (Trivedi and Gunasekaran, 2013). Standard germination test was carried out in plastic box (10x15x6 cm) containing moist pleated paper.The plastic boxes were incubated at 25ºC alternating temperatures with 12 h light/darkness regime and illumination provided by white fluorescent tubes. Seedlings were evaluated at 7 and 21 days days after sowing and the mean normal seedlings, fresh seeds and dead seeds were calculated (ISTA, 1999). The seed lot showing the higher seed vigour index is considered to be more vigorous .The formula for calculating SVI-I and SVI-II as described by (Abdul-Baki and Anderson, 1973) were :

Seedling Vigor index I = Germination% × Seedling length

Seedling Vigor index II = Germination% × Seedling dry weight

As the seed quality deteriorates due to the pathogen association with seeds, a further study was carried out to improve the seed health by using the chemical fungicides as seed treatment. The experiment was laid out in Completely Randomized Design with eight treatments in four replications. Coriander seeds we treated with fungicides viz., T_1- Thiram @3g/kg seed, T_2- Captan @3g/ kg seed, T_3-Carbendazim @1g/ kg seed, T_4- Mancozeb @2.5g/kg seed, T_5- Copper oxychloride @2g/kg seed, T_6- Hexaconazole @2ml/kg seed, T_7- Propiconazole @1ml/ kg seed and T_8- untreated control. Seeds were treated with respective fungicides alongwith untreated control, put in the moisture chamber and incubated at 25 ± 2^{o}C with 12 hours alternate light and dark condition for seven days. Observation was taken on total percentage of bacterial and fungal growth on seeds for each treatment. Seeds were also tested for germination, field emergence, seedling vigour of the treated seeds following standard methods and observations were recorded after twenty one days.

As green plants of coriander are consumed raw hence maximum care should be taken to avoid the chemical fungicides which adversely impact human health and nonchemical methods of disease management should be emphasized. Hence, an experiment was also undertaken for evaluating biocontrol agents as seed treatments, viz. T_1- *Trichoderma viride* (6g/kg seed), T_2- *Trichoderma viride* (8g/ kg seed), T_3- *Pseudomonas fluorescens* (10g/kg seed), T_4- *Pseudomonas flurorescens* (12g/kg seed) and T_5- untreated control in enhancing seed quality parameters like germination percentage, field emergence, vigour under lab condition. Observation on incidence of bacterial and fungal infection on seed were also recorded after 7 days of incubation.

RESULTS AND DISCUSSION

Evaluation of seed quality is an integral part of seed improvement programme. In most of the cases, performance of the seed relates to its ability to germinate and produce a healthy vigorous plant. The quality attributes of farmers' seed samples (Table 1) indicated that the seed moisture content of the seed ranged from 8.1 to 10.7 percent and 15% of the samples had higher seed moisture content than the prescribed limit of 10 percent. Germination of the seed ranged from 36 to 51% and all most all seed samples had germination percentage below the minimum prescribed standard of 65%. The lower germination in the farmers' saved seed may be due to improper post harvest management including storage and pathogens associated with seeds. On the other hand, the TLS collected from the local market conformed to the seed standards for germination and seed moister content. Although seed quality is governed by genetic make-up, commonly the quality of seeds may deteriorate in subsequent stages like harvesting, threshing, processing and storage period. Retention of seed germination always forms the important consideration in agricultural practices.Besides germination, the seed quality was also evaluated on seed vigour calculated on the basis of seedling length (SVI-I) and seedling dry weight (SVI-II). Although there is no specific standard for this trait, the quality of farmers' seed samples was evaluated in comparison to the TLS. It was found that the farmers' seeds, were less vigorous having SVI-I (659.3 to 1048.6) and SVI-II (75.2 to 120.2) as compared with 1064.4 and 151.4, respectively of TLS. Field emergence percentages of majority of the farmers' seeds were also extremely low (30 to 45%) as compared to that of TLS(70%).

As regards the health status of the seed samples, the extent of bacterial infection in the farmers' seeds ranged from 25to 46% and the fungal infection was 18 to 27%. It is quite higher in comparison to the 18% and 15% in bacterial and fungal infection in TLS.

Many authors have reported that not only in coriander crop but in many cereal crops farmers own saved seed were below the certification standards. This is in confirmation with the observation of Huda (1990) who reported that 61.2% of farmers' wheat seed and 49.3% of rice seed samples had germination percentage below standards. Presence of bacterial pathogens like *Pseudomonas, Xanthomonas* and *Erwinia* and fungal pathogens like *Aspergillus niger* and *A. flavus* have been reported in coriander seeds (Garbagnoli and Irigoyen,1998). The results therefore indicated that the farmers' saved seeds are inferior in quality considering different quality parameters. This is in confirmation with the observations reported by a number of workers in a number of crops (Vig *et al.,* 2001). Seed treatment with Carbendazim recorded maximum germination, Field emergence and yield which were 72%, 61% and 90.5g green plants/m2 respectively (Table 2). The second best treatment was Captan @3g/kg and Mancozeb @3g/kg had 69% germination whereas Mancozeb had the maximum field emergence 62%. Rajib *et al.* (1996) had also reported that Carbendazim had better effect for reducing the disease incidence of *Fusarium solani* and increasing the seed yield.The fungicidal treatment with proper dosage and treatment methods were found to preserve the quality of seeds by their well known antifungal effect (Prasanna, 1994). Seed treatments provide an economical crop input that is applied directly on the seed using highly effective

Table 1: Physiological and Health quality status of coriander seeds at farmers' level

District	No. of samples collected	Moisture content %	Germination % (mean & range)	SVI – I	SVI -II	Field emergency %(mean & range)	Bacterial infection % (mean & range)	Fungal infection %(mean & range)
Cuttack	7	(8.1-10.0)	42 (36-48)	930.5	75.2	37(33-40)	36.8(32-46)	21.7(18-26)
Khurda	6	(9.8-10.7)	42(39-46)	659.3	77.4	34(30-36)	31(27-35)	21(18-24)
Puri	5	(8.4-9.2)	46(40-49)	830.6	92.3	37(32-43)	33(26-40)	22(19-26)
Jagatsingpur	5	(8.8-9.4)	43(40-50)	782.2	91.0	31(37-40)	32.8(30-36)	22(18-24)
Kendrapada	4	(8.8-9.4)	44(41-48)	714.0	95.2	36(30-41)	32.5(29-37)	21.5(19-27)
Deogarh	5	(8.1-9.3)	44(40-48)	950.7	141.5	37(34-40)	32(25-42)	22.8(20-27)
Koraput	4	(8.0-8.6)	49(47-51)	1048.6	97.2	39(37-42)	33(29-37)	22.5(19-27)
Kalahandi	4	(8.9-10.2)	47(46-48)	915.2	120.2	30(36-39)	30(29-32)	22.5(20-25)
TLS	1	9.4	73	1064.4	151.4	70	18	15
IMSCS limits	-	10.0	65	-	-	-	-	-

Table 2: Effect of chemical seed treatment on seed microflora and seed quality parameters

Treatments	Germination	Field (%)	Speed of emergence (%)	SVI-I germination	SVI- II	Bacterial Infection(%)	Fungal Infection (%)	Green Plant Yield (g/m^2)
Thiram@3g/kg	66(54.34)	57(49.02)	7.0	1089.0	92.4	(25.77)	(20.23)	84.7
Captan@3g/kg	69(56.17)	59(50.19)	6.5	1317.9	93.9	(27.93)	(16.35)	70.5
Carbendazim@1g/kg	72(58.05)	61(51.36)	6.0	1366.4	144.6	(25.06)	(16.29)	90.5
Mancozeb@2.5g/kg	69(56.17)	62(51.94)	5.5	1346.4	110.4	(25.06)	(21.95)	88.2
Copper oxychloride @2.0g/kg	67(54.94)	59(50.19)	6.6	1214.8	87.1	(30.65)	(22.78)	70.7
Hexaconazole@2ml/kg	57(49.02)	53(46.72)	4.6	1037.4	96.9	(29.27)	(22.77)	65.7
Propiconazole@1ml/kg	61(51.36)	54(47.29)	5.3	677.1	54.9	(29.26)	(23.55)	58.2
Control	50(45.00)	50(45.00)	4.4	655.0	45.0	(31.91)	(25.06)	60.5
SE(m)±	0.52	0.52	0.06	14.98	1.27	1.13	0.83	2.49
CD	1.54	1.54	0.19	43.72	3.73	3.31	2.45	7.28

*Figure in parenthesis are angular transformed values

Table 3: Effect of seed treatment with bicontrol agents on seed quality parameters.

Treatments	Germination (%)	Field emergence (%)	Speed of germination	SVI-I	SVI-II	Bacterial infection(%)	Fungal infection	Green plant yield (%)(g/m^2)
Trichoderma viride @ 6g/kg	62(51.94)	61(51.35)	5.15	1302	117.8	26.52	21.94	80.5
Trichoderma viride @ 8g/kg	71(57.42)	65(53.73)	5.32	1583.3	142	25.06	20.22	90.5
Pseudomonas fluorescens @10 g/kg	59(50.18)	55(47.87)	4.65	949.9	88.5	27.95	21.06	84.25
Pseudomonas fluorescens @ 12g/kg	64(53.13)	62(51.94)	4.75	1107.2	108.8	27.96	18.38	74.25
Control	50(45)	50(45)	4.5	655	45	31.91	25.03	59.75
SE(m)±	0.49	0.58	0.06	14.54	1.3	0.9	0.96	0.73
CD	2.89	4.17	0.18	43.83	3.93	9.99	11.37	2.2

*Figure in parenthesis are angular transformed values

technology. Moreover, other crop protection techniques are now being replaced with seed treatments by virtue of their residual systemic efficacy (Schwinn, 1994). Considering seedling vigour index as an important quality attribute seed treatment with Carbendazim recorded maximum SVI-I (1366) and SVI-II (144) followed by seed treatment with Mancozeb having SVI-I and SVI-II as 1346 and 110 respectively. To keep the uniformity in the plant growth, the seed treatment with Thiram was found effective as it had recorded the maximum speed of germination as 7.0. Seed treatment with Carbendazim and Mancozeb recorded the minimum bacterial infection of 25% and similarly seed treatment with carbendazim and captan had also recorded to have minimum fungal infection of 16%. Champawat and Pathak, 1991 have also stated that seed treatment with Carbendazim increased yield by lowering the bacterial and fungal infection of seeds. As the seed treatment with Carbendazim minimizes the fungal and bacterial infection in the coriander seed, the germination and field emergence increased.Research efforts in alternative methods to chemical crop protection are currently being addressed worldwide especially with regards to food safety and environmental sustainability (Nicholas and Groot, 2013). Seed treatment with biocontrol agents also resulted in significant improvement in seed quality. Among all the biocontrol agents *Trichoderma*

Viride (8g/kg seed) gave highest germination, field emergence and yield which were 71%, 65% and 90. 5g green plant/m^2, respectively (Table 3).

Seeds are considered as basic input and output in agriculture. Whereas, the productions and timely supply of quality seeds to the farmers are most crucial and challenges the technology. Therefore, production of quality seed and maintenance of high germination is of utmost significance in the seed program. The results indicated that there was significant difference among the seed treatment with bio-agents at different doses. Seed treatment with *T.viride* @8g/kg recorded maximum SVI-I and SVI-II as 1583 and 142, respectively. *T. viride* @8g/kg seed was found to be most effective in increasing the speed of germination upto 5.32. Seed treatment with T.viride @8g/kg recorded the minimum bacterial infection (18%) where as *P.fluorescence* @12g/kg have recorded the lowest fungal infection (10%). Bio agents such as *T.viride* and *P.fluorescence* are able to suppress the pathogenic expression especially (Azcon,1989).Increased aerobic activity of micro organism increases the release of CO_2which in turn inhibits the growth of pathogen and helps to build up the seed health. These micro-organisms also release some enzymes which help to improve the seed health status and check infection by pathogenic fungi (Anonymous, 2002). Based on the above study, it can be concluded that seed treatment with chemical fungicide carbendazim@3g/kg is found most effective in increasing the quality of seed saved by the farmers. But owing to so many problems in view of ecosystem and environment, seed treatment with *Trichoderma viride* @ 8g/Kg seed is found most effective in managing seed infection, seed quality and higher green plant yield. In this way, seed enhancements technology plays a significant role in improvising the seed performance of coriander. Use of bio-pesticides for sustainable production in an eco-friendly manner is an essential component. Hence the bio-agents and fungicide combinations would be incorporated in the integrated management of disease incidence under field conditions in future in coriander Seed treatment must be an initial step of raising a farmers crop and has a pivotal role in sustainable crop production which cannot be ignored.

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