Effect Of Fungicides In Controlling Root Rot (*Fusarium Solani*) Of Chickpea

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Abstract: A field experiment was conducted in the field of Bangladesh Institute of Nuclear Agency sub-station, Ishurdi to determine the effect of different fungicides in controlling root rot of chickpea. Germination of chickpea were increased by treating seeds with secure 600WG (48.62%) followed by provax 200WP (44.38%) over control. Pre-emergence death of chickpea decreased up to 30.42% by treating seeds with secure 600WG over control. The lowest disease incidence (8.68%) was found in secure. Secure 600WG treating seeds decreased disease incidence 70.05% followed by Bavistin 68.57% over control. Seed treated with Secure 600WG and Bavistin increased plant stand by 28.56% and 27.97%, respectively over control. Maximum shoot length (11.78%) was found when seeds were treated with Secure 600WG, while maximum root length (21.80%) was recorded when seeds were treated with Provex 200WP over control. Seeds treated with Secure 600WG, Provex 200WP and Bavistin increased vigour index up to 66.94%, 63.28% and 56.68% over control. Seed treated with Secure 600WG resulted highest fresh weight of biomass (3031) which was 82.32% higher over control. Seeds treated with Secure 600WG also resulted highest grain yield **(**192.1g/m^2) which was 81.50% higher over control.

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1. Introduction

Chickpea (*Cicer arietinum* L.) belongs to the family leguminosae is the world's third most important food legume and the third major pulse crop after grass pea and lentil (Islam *et al.*, 1981 and Anon, 1998). Chickpea seeds are eaten fresh as green vegetables, parched, fried, roasted and boiled as snack food, sweet and condiments. Digestibility of protein varies from 76-78% and its carbohydrate from 57-60% (Huisman and Van der poel, 1994). Chickpea seeds contain essential amino acids like isoleucine, leucine, lysine, phenylalanine, and valine (Karim and Fattah, 2006). Additionally, it is rich in minerals (phosphorus, calcium, magnesium, iron and zinc), fiber, unsaturated fatty acids and β-carotene (Jukanti *et al.*, 2012). Chickpea meets 80% of its nitrogen requirement from symbiotic nitrogen fixation and can fix up to 140 kg N/ha from air (Ullah, 2002). Chickpea returns a significant amount of residual nitrogen to the soil and adds organic matter, improving soil health and fertility.

Though chickpea play a vital role in contributing many vitamins and protein, their average yield is decled various causes are associated with lower yield of it in the country. Out of the causes disease play one of the most important factors of yield reduction. It is attacked by about 67 fungi, 3 bacteria, 22 viruses and mycoplasma and 80 nematodes (Nene *et al*., 1996).

Different phytopathogenic seed borne as well as soil-borne fungi are the most destructive pathogen causing root rot disease (Nene *et al.,* 1996). Root rot (*Fusarium oxysporum, Fusarium solani* and *Sclerotium rolfsii*) is considered as the important and destructive disease of pulse in Bangladesh and also in almost all legume growing countries of the world (Fakir, 1983; Ahmed, 1985). Sometimes this causes severe yield loss i.e., 60-70 per cent under favorable conditions (Tewari and Mukhopadhyay, 2003). It causes complete loss in grain yield if the disease occurs in the vegetative and reproductive stages of the crop (Navas *et al.,* 2000). There is no any effective control measure to remove the diseases. A few effective fungicides are available in the market. Considering the very limited work on the management of root rot of chickpea and reduction of yield loss, the current piece of research was undertaken to evaluate the fungicides in controlling root rot of chickpea.

2. Materials and methods

A field experiment was conducted in the sub-station field of Bangladesh Institute of Nuclear Agriculture (BINA), Ishurdi, Pabna during the winter season of 03 December 2012 to 30 April 2013. A root rot susceptible variety Binasola-2 was used as a test crop. The experiment was conducted in RCBD (Randomized Complete Block Design) having three replications. The individual size of the plot was 3 m x 2.4 m. The space between blocks and between plots was 1.0 m and 0.5 m respectively. The following eight treatments were used as seed treatment- (1) Folicure 200W (@ 2.5g/kg), (2) Provex 200WP (@ 2.5g/kg), (3) Mancosil (@ 2.5g/kg), (4) Secure 600WG (@ 2.5g/kg), (5) Du-du 70SL (@ 2.5ml/kg), (6) Bavistin (@ 2.5g/kg), (7) Control (soil inoculated with pathogens).

A total of 360g of mass culture (grown in chickpea) of *Fusarium oxysporum, Fusarium solani* and *Sclerotium rolfsii* were inoculated in field soil to every replication except control-2 plot 48 hrs before sowing the seeds. Seeds were treated with granular chemicals @ 2.5g/kg and liquid Chemicals @ 2.5ml/kg. Treated seeds were sown in field about 2.0 cm depth in 7 lines per plot, where 36 seeds were sown in each line. The seeds were sown at afternoon on 03rd December 2012. The following data were recorded: Germination, pre-emergence death, disease incidence, plant stand, shoot length/plant, root length/plant, vigour index (VI), fresh weight of biomass, no of pods/plant and grain weight (g/m^2). Diseases Incidence was calculated following the formula:

$$\%\text{ Disease incidence} = \frac{\text{Number of infected plant in each plot}}{\text{Total number of plant in each plot}} \times 100$$

Vigour index (VI) was calculated by using the formula of (Abdul Baki and Anderson, 1973) as shown below: Vigour Index (VI) = (Mean shoot length + mean root length) × % germination.

3. Result and Discussion

The highest germination (92.9%) at 14 DAS (Days After Sowing) of chickpea was found in secure. The germination was found to be increased by treating seeds with secure (48.62%) followed by provex (44.38%) over control. It has been observed that treating seeds with secure decreased pre-emergence death up to 30.42% compaired to control (table 1& 2). Deshmukh and Raut (1989) reported that Seed treated with thiram, rovral, captan, rovral + thiram, thiram + carbendazim, dithan M-45 + carbendazim, dithane Z-78 + carbendazim and rovral + carbendazim @ 0.3% were most effective which eliminated the seed-borne fungi to greatest extent and improved the germination by 29% over control. Thakur *et al.* (2002) reported bavistin, benomyl and captan give the highest chickpea seed germination (91.6, 83.3 & 75.0%) over control. Andrabi *et al.* (2011) reported that seed treatment with carbendazim increased seed germination (71.24%), though it was at par with carbendazim + mancozeb (62.21%) and mancozeb (61.46%).

The lowest disease incidence (8.6%) at harvest was found in secure. It has been observed that reduction of disease incidence by treating seeds with secure (70.05%) followed by bavistin (68.57%) over control (table 3). This finding has been supported by many researchers. Dhyani *el al.* (1990) found thiram gave the best control of seed borne fungi followed by captafol and mancozeb. Champawat and Pathak (1991) stated that seed treatment with carbendazim and benomyl gave the best disease control. Rajib *et al.* (1996) reported that carbendazim (bavistin WP) was superior to carboxin for reducing wilt. Andrabi *et al.* (2011) reported that carbendazim applied as seed treatment reduced disease incidence significantly. Nikam *et al*. (2007) reported that chemical seed treatment with thiram (0.15%) and carbendazim (0.1%) was proved to be the most effective against *Fusarium oxysporium* f. sp. *ciceri*.

The highest plant stand (91.3%) at harvest was found in secure. It has been observed that plant stand increases when seeds were treated with secure (28.56%) and bavistin (27.97%) over control (table 4). This founding is supported by Ganeshan (1997). He reported that seed treatment by soaking seeds overnight in a 0.2% solution of mancozeb produced a crop stand of 43% mancozeb and captafol when administered as soil dry mix gave up to 75 and 77% control, respectively.

The highest shoot length, vigour index and fresh weight of biomass were found in secure (table 5). Seeds treated with secure increased shoot length by 11.78%, provex increased root length by 21.80% over control. It has been found that seeds treated with secure, provex and bavistin increased vigour index up to 66.94%, 63.28% and 56.68%, respectively over control. It has been observed that seeds treated with secure have highest increase in fresh weight of biomass up to 82.32% over control. This founding is supported by many researchers. Thakur *et al*. (2002) reported that bavistin, benomyl and captan were significantly superior values for increasing shoot and root lengths, fresh and dry weights. Thakur *et al.* (2004) reported that bavistin at 0.3% gave the highest shoot length and fresh weight. captan, benomyl and mancozeb gave the highest root length, dry weight and number of nodules.

The number of pods/plant (36.1) was the highest in provax which followed by secure (35.9). the highest grain weight (192.1 g/m^2) was found in secure (table

6). Seeds treated with secure gave highest increase of grain weight up to 81.50% which is statically similar to provex 74.15% and bavistin 70.87% over control (table 6). This finding is related with Rao (1989). He reported that seed treatment of cowpea with 0.2% mancozeb against seed-borne diseases caused by *C. lindemuthianum* and *M. phaseolina* resulted in 14% yield increase and successfully controlled the diseases. Champawat and Pathak (1991) stated that seed treatment with carbendazim and benomyl increased yield. Rajib *et al.* (1996) reported that carbendazim (bavistin WP) was superior to carboxin for reducing wilt for increasing seed yield. Hossain (1999) observed maximum grain yield of lentil was when seeds were treated with 0.2% bavistin. Based on the findings of the present study it may be concluded that Secure 600WG can be used for controlling root rot of chickpea.

Table 1. Effect of different fungicides on germination of chickpea seeds

Treatments	% Germination		
	6 DAS	10 DAS	14 DAS
Folicure 200W	55.82bc	80.17b	85.05b (+ 35.93)
Provax 200WP	60.32ab	85.45ab	90.34ab (+ 44.38)
Mancosil	57.94ab	81.61ab	88.10ab(+ 40.80)
Secure 600WG	62.43a	87.70a	92.99a(+ 48.62)
Du-du 70SL	55.95bc	81.22ab	86.37ab(+ 38.04)
Bavistin	59.26ab	83.87ab	88.63ab(+ 41.65)
Control	48.02d	58.07d	62.57d
$LSD_{(P \geq 0.05)}$	5.09	6.17	6.43

Data represent the means of three replications. Means having common letter (s) do not differ significantly. Data in parenthesis indicate % increase (+) over control. DAS: Days After Sowing

Table 2. Effect of different fungicides on pre-emergence death of chickpea seeds

Treatments	% pre-emergence death		
	6 DAS	10 DAS	14 DAS
Folicure 200W	44.18bc	19.84c	14.95c(- 22.48)
Provex 200WP	39.68de	14.55ef	9.657e(- 27.77)
Mancosil	42.06cd	18.39cd	11.90d(- 25.53)
Secure 600WG	37.57e	12.30f	7.01f(- 30.42)
Du-du 70SL	44.05bc	18.78c	13.63c(- 23.80)
Bavistin	40.74cde	16.14de	11.37d(- 26.06)
Control	51.98a	41.93a	37.43a
$LSD_{(P \geq 0.05)}$	3.74	2.49	1.49

Data represent the means of three replications. Means having common letter (s) do not differ significantly. Data in parenthesis indicate % decrease (-) over control. DAS: Days After Sowing

Table 3. Effect of different fungicides on disease incidence of chickpea

Treatments	% Disease incidence		
	20 DAS	45 DAS	Harvest
Folicure 200W	3.73c	7.46c	12.13c (- 58.11)
Provex 200WP	2.63de	5.27e	10.25de (-64.63)
Mancosil	3.15d	6.75d	11.11cd (-61.58)
Secure 600WG	1.85f	4.27f	8.68f (- 70.05)
Du-du 70SL	2.60de	6.43d	11.18cd (- 61.40)
Bavistin	2.24ef	4.77ef	9.10ef (-68.57)
Control	6.76a	13.53a	28.97a
$LSD_{(P \geq 0.05)}$	0.553	0.655	1.30

Means having common letter (s) do not differ significantly. Data in parenthesis indicate % decrease (-) over control. DAS=Days After Sowing

Table 4. Effect of different fungicides on plant stand of chickpea

Treatments	% Plant stand		
	20 DAS	45 DAS	Harvest
Folicure 200W	96.27abc	92.54ab	87.87a(+ 23.70)
Provex 200WP	97.37ab	94.73ab	89.75a(+ 26.35)
Mancosil	96.85ab	93.25ab	88.89a(+ 25.14)
Secure 600WG	98.15a	95.73a	91.32a(+ 28.56)
Du-du 70SL	97.40ab	93.57ab	88.82a(+ 25.00)
Bavistin	97.76a	95.23ab	90.90a(+ 27.97)
Control	93.24c	86.47c	71.03c
$LSD_{(P \geq 0.05)}$	3.23	5.42	7.41

Data represent the means of three replications. Means having common letter (s) do not differ significantly. Data in parenthesis indicate % increase (+) over control. DAS: Days after sowing

Table 5. Effect of different fungicides on shoot length, root length, vigour index and fresh weight of biomass (g/m^2) of chickpea

Treatments	Shoot length/ plant (cm)	Root length/ plant (cm)	Vigour index (VI)	Fresh weight of biomass (g/m^2)
Folicure 200W	55.50abc (+5.29)	17.44bc (6.79)	6204cd (+43.64)	2611 (+57.06)
Provex 200WP	58.17ab (+10.36)	19.89a (+21.80)	7052ab (+63.28)	2840 (+70.84)
Mancosil	55.08abc (+4.49)	17.60bc (+ 7.78)	6403bc (+ 48.25)	2743 (+64.99)
Secure 600WG	58.92a (+11.78)	18.61ab (+13.96)	7210a (+66.94)	3031 (+82.37)
Du-du 70SL	54.60bc (+3.59)	17.05bc (+ 4.41)	6189cd (+43.29)	2651 (+59.48)
Bavistin	57.85ab (+9.75)	18.50ab (+13.29)	6767abc (+56.68)	2890 (+73.85)
Control	52.71c	16.33c	4319e	1662
$LSD_{(P \geq 0.05)}$	3.74	1.91	703.30	476.0

Data represent the means of three replications. Means having common letter (s) do not differ significantly. Data in parenthesis indicate % increase (+) over control.

Table 6. Effect of different fungicides on no. of pod/plant and grain weight of chickpea

Treatments	No. of pods/ plant	Grain weight (g/m^2)
Folicure 200W	35.33	166.4b (+ 57.28)
Provex 200WP	36.10	184.3ab (+ 74.20)
Mancosil	34.80	171.9ab (+ 62.48)
Secure 600WG	35.90	192.1a (+ 81.57)
Du-du 70SL	35.07	169.4b (+ 60.11)
Bavistin	35.63	180.8ab (+ 70.89)
Control	35.43	105.8d
LSD $_{(P\geq 0.05)}$	-	18.770

Data represent the means of three replications. Means having common letter (s) do not differ significantly. Data in parenthesis indicate % increase (+) over control.

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