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RESEARCH PAPER

Field evaluation of different fungicides against rust and powdery mildew disease of blackgram (*Vigna mungo* L.)

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Abstract : Taqat 75 WP is a new combination product of captan 70 per cent (contact) and hexaconazole 5 per cent (Systemic) proved effective against fungal diseases of blackgram *i.e.* rust and powdery mildew diseases. Hence, in the present study, taqat 75 WP was evaluated in comparision to other commonly used fungicides against foliar disease of blackgram. A field experiment was conducted at farmers field of Gariyaband district of Chhattisgarh state during *Kharif* 2013 and 2014 to evaluate the efficacy of taqat 75 WP against foliar fungal disease of blackgram. The results revealed that taqat 75 WP @ 750 g ha^{-1} was highly effective in controlling the incidence of rust and powdery mildew in blackgram. Results also revealed that taqat 75 WP @ 750 g ha^{-1} increased the seed yield and yield attributing characteristics like number of pods $plant^{-1}$, number of seeds pod^{-1} and 1000 seed weight.

Key Words : Blackgram, Fungicides, Foliar fungal disease, Powdery mildew, Rust

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INTRODUCTION

India is an important pulse growing country contributing 28 per cent to the global pulse basket from an area of about 37 per cent (Masood and Kumar, 2000). Urdbean, commonly known as blackgram (*Vigna mungo* L.), is a vital crop grown throughout Asia, Australia, West Indies, South and North America, tropical and sub tropical Africa. Asia alone accounts for 90 per cent of world's blackgram production. India is the world's largest blackgram producer accounting for about 65 per cent world's acerage and 54 per cent of its global production (Singh, 2011). In India the total production of black gram is 1.74 million tonnes from an area of 3.26 million ha with a productivity of 534 kg/ha (Anonymous, 2012). Among pulses, black gram has increased from 1.87 m ha in 1971–72 to 3.11 m ha during 2012-13 with production level of 1.90 MT (ESI, 2015). It is an important short duration pulse crop grown throughout the year in Chhattisgarh under different agro-climatic conditions, such as *Kharif*, *Rabi* and *Zaid* crop mostly in uplands. As far as Chhattisgarh state is concerned, the total production of blackgram is 31.2 thousand tones from an area of 50.9 thousand ha with productivity of 613 kg ha^{-1}. Though grown in large area, the

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productivity was low due to various biotic and abiotic stresses. The main reasons for low yield are the succeptibility of the crop to insects, weeds and diseases caused by fungus, virus and bacteria.

Among the biotic stress, diseases are responsible for an estimated yield loss of 20 to 30 per cent (Singh, 1995). Around 45 viruses are reported to infect legumes (Bos *et al.*, 1988 and Makkouk *et al.*, 2003) worldwide. However, only few are of major economic concern with respect to specific regions. Yellow mosaic, Cercospora leaf spot and powdery mildew diseases that attack blackgram pulse are considered economically important (Vishwa *et al.*, 2004). Powdery mildew is distributed in India and Southeast Asian countries and becomes severe in dry season causing 9.0-50.0 per cent yield loss (Reddy *et al.*, 2008 and Pandey *et al.*, 2009). Among foliar fungal diseases, powdery mildew and rust are the more prevalent disease on blackgram, which occurs at later stages of crop growth. Powdery mildew caused by *Erysiphe polygoni*, is a problem in cool dry weather. Pathogen is obligate parasite and has wide host range (Pandey *et al.*, 2009). The yield losses caused by foliar disease are proportional to the disease severity depending upon the stage of infection, genotypes and environmental conditions. Yield loss is much high when the pathogen infects the crop before flowering, however, it results in complete loss of the crop if disease occurs at seedling stage. Abbaiah (1993) reported that the powdery mildew in black gram was generally noticed in 45 days old crop. Hence, the use of fungicide has become inevitable in controlling the foliar diseases in the absence of suitable resistant cultivars. To overcome this problem, the present study was conducted at farmers field to test the efficacy of new fungicide, taqat 75 WP against foliar fungal disease of blackgram.

Taqat 75 WP is a new combination product of captan 70 per cent (contact) and hexaconazole 5 per cent (Systemic) proved effective against both fungal diseases of blackgram *i.e.* rust and powdery mildew diseases (Adinarayana *et al.*, 2013). Hence, in the present study, taqat 75 WP was evaluated in comparision to other commonly used fungicides against foliar disease of blackgram.

MATERIAL AND METHODS

The present study was conducted during consecutive *Kharif* season of year 2013 and 2014 at farmers field of Village Sambalpur in Gariyaband district of Chhattisgarh Plains. This experiment was planned in Randomized Block Design with four treatments including untreated control each replicated six times with plot size of one acre. The soil of the farmers field was sandy loam in texture, neutral in reaction and had low nitrogen, medium phosphorus and potassium contents. Four different fungicides were tested during experimentation. The treatments contain T_1 - Untreated control, T_2 - Tridemorph 75 per cent EC (500 ml ha^{-1}), T_3 - Karathane 48 per cent EC (500 ml ha^{-1}) and all was tested against T_4 – Taqat 75 WP (750 g ha^{-1}). Blackgram variety TU-94-2, which is succeptible to powdery mildew and rust was selected for the study. The crop was sown manually after onset of monsoon with spacing of 30 cm and 10 cm between rows and plants, respectively using a certified seed with seed rate of 20 kg ha^{-1}. To prevent the crop from soil and seed borne diseases, the seeds were treated with thiram @ 3 g kg^{-1} seed and *Rhizobium* culture. The crop was fertilized with basal dose of 20, 60 and 30 kg N, P_2O_5 and K_2O ha^{-1}, respectively and was grown under rainfed condition by adopting all agronomic practices as per recommendation of IGKV, Raipur except fungicide application. The crop was protected from the infestation of both sucking pests and pod borers through blanket application of selective insecticides in all experimental field uniformly to avoid the yield losses due to insects.

First spray of fungicides as per treatments, was taken up after initial appearance of disease in crop and further sprays were given at 15 days interval with knap sack sprayer at the rate of 500 litre of spray fluid per hectare for thorough coverage of foliage with spray fluid. The severity of rust and powdery mildew were recorded one day before the spray from four randomly selected area of each plot with the help of 1 m^2 quadrate and is expressed in term of percentage and finally after three sprays, their mean percentage was calculated by using following formula:

$$\text{Per cent disease incidence (PDI) \%} = \frac{\text{Number of plants infected by disease}}{\text{Total number of plants observed}} \times 100$$

The harvesting was done manually with the help of sickle, when the crop attained full maturity. The produce of a square meter from four randomly selected of each plot was tied into bundle and allowed to sun drying in respective plots. The harvested bundles were transported to threshing floor. Threshing of produce of each plot was done separately by beating with wooden sticks then seeds were cleaned manually and weighed. Number of pods per plant was calculated by counting the total number of pods from four randomly selected

square meter area plants and was presented by its average value number. Thereafter, these pods are subjected for counting number of seeds per pod by taking their average value.

Seed yield of the net plot was noted down, after threshing, winnowing and drying and calculated in qha^{-1}. The data were subjected to statistical analysis after using transformations for per cent disease incidence.

RESULTS AND DISCUSSION

In general the incidence of both diseases *i.e*. powdery mildew and rust was slightly higher during *Kharif* 2014 when compared to *Kharif* 2013 (Table 1). The mean per cent rust disease incidence was ranged from 0 to 43.71 and mean per cent powdery mildew disease incidence was ranged from 1.48 to 54.01 in different experimental treatments.

Effect on per cent disease incidence of rust and powdery mildew :

The results showed that all three tested fungicide were found effective in controlling rust and powdery mildew diseases of blackgram. However, taqat 75 WP was found significantly superior and was effective against both diseases as compared to other tested fungicides, and recorded nil per cent rust incidence in both the experimental year. The maximum rust disease incidence in both experimental year of 2013 and 2014 was found in untreated control plot (40.61 and 46.81%, respectively) with mean per cent of 43.71. Spraying of karathane 48 EC recorded 2.34 and 3.65 per cent rust disease incidence and tridemorph recorded 8.56 and 12.20 per cent rust disease incidence in both consecutive experimental year of *Kharif* 2013 and 2014, respectively. Dadke (1996) reported that hexaconazole (0.05 %) was effective in controlling rust disease among various fungicides. Adinarayan *et al.* (2013) also reported the similar findings in which he stated that taqat 75 WP at concentration of 500 and 750 g ha^{-1} was found effective against rust.

Similarly, powdery mildew was also proscribed very effectively with the test fungicide during both the seasons. Taqat 75 WP was found highly effective in suppressing the disease incidence of powdery mildew in blackgram and was found significantly superior over all other tested fungicides. However, karathane 48 EC and tridemorph 75 EC was also found effective against suppressing powdery mildew incidence in blackgram. The highest disease incidence per cent was recorded in untreated control plot with 51.23 and 56.80 per cent powdery mildew incidence in both consecutive year, respectively. Nagaraja and Naik (1998) also reported efficacy of triazoles such as propiconazole, penconazole and difenconazole against powdery mildew diseases. Dhruj *et al*. (2000) reported that the fungicides tridemorph, carbendazim and sulphur significantly reduced the incidence of powdery mildew disease. Khunti *et al*. (2002) also observed that penconazole and hexaconazole effectively minimized the disease intensity of powdery mildew and increased the yield to considerable extent. Similar findings was also observed by Mittal (1994).

The tested compound taqat 75 WP was proved effective against both rust and powdery mildew diseases which might be due to its triazole component, hexaconazole. Since, the efficacy of triazoles against foliar fungal disease in different crops is well documented.

Effect on number of pods plant^{-1}:

The result on different tested fungicides on number of pods plant^{-1} of blackgram revealed that taqat 75 WP was found significantly superior over other tested fungicides at both experimental year (19.27 and 18.20, respectively). However, it was at par with spraying of karathane 48 EC (19.06 and 17.95) in both the year. tridemorph 75 EC (16.81) also recorded at par result with karathane 48 EC in *Kharif* 2014. The lowest number of pods plant^{-1} was recorded in untreated control plot

Table 1 : Effect of different fungicides on rust and powdery mildew disease incidence per cent of blackgram

Treatments	Mean percentage after 3 sprays					
	Rust disease incidence (%)		Mean	Powdery mildew disease incidence (%)		Mean
	2013	2014		2013	2014	
T_1 – Untreated Control	40.61	46.81	43.71	51.23	56.80	54.01
T_2 – Tridemorph 75 % EC (500 ml ha^{-1})	8.56	12.20	10.38	14.60	17.40	16.00
T_3 – Karathane 48 EC (500 ml ha^{-1})	2.34	3.65	2.99	7.62	5.25	6.43
T_4 – Taqat 75 WP (750 g ha^{-1})	0.00	0.00	0.00	0.95	2.01	1.48
S.E.±	1.32	2.17		1.66	1.66	
C.D. (P=0.05)	3.89	6.41		4.80	4.91	

(13.22 and 12.98) in both year of experimentation with mean of 13.10 numbers of pod plant^{-1}. This might be due to lower translocation of food materials from source to sink due to disease incidence. Bhat *et al*. (2015) also find similar results and stated that spray with hexaconazole (0.02 %) ensured significant reduction in pod infection (77 %) and leaf spot intensity (68 %) besides supporting proportionately attractive seed yield (8.62-8.95 q/ha) at an acceptable B:C (6.38:1). The result was in confirmity with Khan *et al*. (2009) in which they find the treatment of plants with fungicides showed lower disease severity and higher pod number than those where no such treatment was applied (untreated check).

Effect on number of seeds pod^{-1} :

As far as number of seeds pod^{-1} of blackgram is concerned, similar result was obtained as found in number of pods plant^{-1}. Plot spraying with fungicide taqat 75 WP recorded highest number of seeds pod^{-1} (6.32 and 6.16) in both season and was found significantly higher over other treatments. However, in both year, plots sprayed with fungicide karathane 48 EC recorded at par result with taqat 75 WP. Karathane 48 EC and tridemorph 75 EC were also found at par result with each other in the first year of experimentation. The lowest number of seeds pod^{-1} was found in untreated control (5.28 and 5.02) with mean number of 5.15 seeds pod^{-1}. This might be due to its attributing characters. More the translocation of food materials from source to sink, more will be the number of seeds in pod.

Effect on 1000 seed weight :

Results on 1000 seed weight against different tested fungicides revealed that among all treatments taqat 75 WP was found effective and significantly superior over other tested fungicides. Taqat 75 WP recorded highest 1000 seed weight (42.19 g and 41.34 g) in both consecutive year of experimentation with mean value of 41.77 g. However, it was at par with karathane 48 EC (40.05 g) in the second year of experiment. The lowest seed weight was recorded under untreated control plot (30.96 g and 29.90 g) with mean weight of 30.43 g. Adinarayana *et al*. (2013) also stated that fungicidal treatment not only increase the yield but grain quality was also superior, when compared to control plots.

Effect on yield (q ha^{-1}) :

The result obtained in the present study revealed that all the treatments significantly increased the seed yield over the untreated control. Highest seed yield was obtained from the experimental plots treated with fungicide taqat 75 WP during both the seasons (10.01 q ha^{-1} and 9.87 q ha^{-1}) with mean yield of 9.94 q ha^{-1} and was found significantly higher over any other tested fungicides followed by karathane 48 EC (8.60 and 7.41) and tridemorph 75 EC (6.82 and 6.54) (Table 2). The lowest seed yield was obtained under untreated control in both year of experimentation (5.23 q ha^{-1} and 4.15 q ha^{-1}) with mean seed yield of 4.69 q ha^{-1}. The results were in conformity with Adinarayan *et al.* (2013) in which they stated that seed yield was highest from the experimental plots treated with taqat 75 WP at 750 g ha^{-1}. Chattannavar *et al*. (2010) also repoted that taqat at 750 g ha^{-1} was effective and found at par with propiconazole 0.1 per cent . While, Bhattiprolu (2010) reported that taqat 75 WP was found effective in controlling leaf spots caused by *Alternaria*, *Helminthosporium* and *Cercospora*. Khunti *et al*. (2002) also observed that penconazole and hexaconazole effectively minimized the disease intensity of powdery mildew and increased the yield to considerable extent. Similarly, Patil and Anahosur (1998) reported that hexaconazole at 0.1 per cent sprayed at 15 days interval starting from onset of disease found effective in reducing severity of rust with significant increase in seed yield.

Table 2: Effect of different fungicides on number of pods plant^{-1}, number of seeds pod^{-1} and yield of blackgram during experimental year of *Kharif* 2013 and 2014

Treatments	No. of pods plant^{-1}		Mean	No. of seeds pod^{-1}		Mean	1000 grain weight (g)		Mean	Yield (q ha^{-1})		Mean
	2013	2014		2013	2014		2013	2014		2013	2014	
T_1 – Untreated control	13.22	12.98	13.10	5.28	5.02	5.15	30.96	29.90	30.43	5.23	4.15	4.69
T_2 – Tridemorph 75 % EC (500 ml ha^{-1})	17.42	16.81	17.12	5.85	5.47	5.66	37.35	37.02	37.19	6.82	6.54	6.68
T_3 – Karathane 48 EC (500 ml ha^{-1})	19.06	17.95	18.15	6.05	5.90	5.98	40.66	40.05	40.36	8.60	7.41	8.01
T_4 – Taqat 75 WP (750 g ha^{-1})	19.27	18.20	18.74	6.32	6.16	6.24	42.19	41.34	41.77	10.01	9.87	9.94
S.E.±	0.57	0.45		0.11	0.09		0.37	0.86		0.21	0.13	
C.D. (P=0.05)	1.73	1.36		0.32	0.28		1.10	2.58		0.44	0.40	

Conclusion :

From present study, it was concluded that spraying of taqat 75 WP @ 750 g ha^{-1} were highly effective in controlling the incidence of foliar fungal diseases, such as rust and powdery mildew in blackgram. This also concluded that taqat 75 WP @ 750 g ha^{-1} increased the seed yield and yield attributing characteristics like number of pods $plant^{-1}$, number of seeds pod^{-1} and 1000 seed weight due to less incidence of disease.

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