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SEED TREATMENTS INDUCED SYSTEMIC RESISTANCE IN CHICKPEA AGAINST FUSARIUM WILT IN WILT SICK FIELD

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Abstract

Induced systemic resistance in chickpea against wilt disease caused by *Fusarium oxysorum* f. sp. *ciceri* (FOC) was studied by treating the seeds with benzo (1,2,3)-thiadizole-7-carbothioic acid - s- methyl ester (Bion), salicylic acid (SA) and di- potassium hydrogen phosphate (K_2HPO_4). Reduction in disease was observed in both type of applications but seed dressing was found more effective than soaking method. Highest reduction, 63% in wilt disease was observed with Bion dressing followed by SA, 40% and K_2HPO_4 , 30%. Bion and SA showed 41 & 24% reduction in the disease, respectively, when seeds were soaked in the respective chemicals but no reduction was found with K_2HPO_4 soaking. Slight increase in yield was observed with all the treatments in both applications but difference among them was statistically non-significant.

Introduction

Chickpea (*Cicer arietinum* L.) is the world's third most important pulse crop after dry beans (*Phaseolus vulgaris* L.) and dry pea (*Pisum sativum* L.) (Nikam *et al*., 2007). It has nutritional properties and affordable prices compared to animal proteins, chickpea is one of the major staple food, especially for people with limited income. Pakistan is the third major chickpea producer in the world after India and Turkey (Dusunceli *et al*., 2007). Fusarium wilt caused by *Fusarium oxysorum* f. sp. *ciceri* is one of the major diseases of chickpea. The fungus invades plant vascular tissues and induces severe wilting of the foliage by blocking xylem transport and impeding the movement of water (Beckman *et al*., 1989; Haq & Jamil, 1995). The pathogen is both seed and soil born; facultative saprophyte and can survive in soil up to six years in the absence of susceptible host (Haware *et al*., 1986). Considering the nature of damage and survival ability of the fungus, use of resistant varieties is the only economical and practical solution. Most of the resistant varieties have been found to become susceptible after some years because of evolution in the virulence of the pathogen. In resent years, the process of "immunization" or induced resistance to diseases has received increasing attention (Vallad & Goodman, 2004). Induced resistance can be achieved with certain environmentally safe chemicals (Kuc, 2006). It has been reported that salicylic acid, acetyl salicylic acid and Bion have induced systemic resistance in chickpea against wilt disease under controlled environments (Saikia *et al*., 2003; Sarwar *et al*., 2005). This paper reports that seed dressing with salicylic acid, Bion and di-potassium hydrogen phosphate can induce systemic resistance in chickpea against wilt disease.

Materials and Methods

Seeds of chickpea variety Bittal 98 {(tolerant to *Fusarium* wilt (unpublished data)} were treated with 0.014% Salicylic acid (SA), 0.017% Bion and 0.8% K_2HPO_4 by

soaking (w/v) and dressing (w/w). In soaking treatment, seeds were completely dipped in the solutions for 12 hours while in dressing seeds were shaken with wet powder of the chemicals for 2 hours before sowing. Seeds for control plants were treated with water only. Treated seeds 120 were sown in small plots of 2x5 meter in three replicates by applying completely randomize design in wilt sick field. Disease data were recorded by counting the wilted plants and total plants in that small plot at regular intervals through out the experimental period. At maturity every replicate of each treatment was harvested separately and weighed. Data was analyzed statistically by applying analysis of variance and Duncan's multiple range tests.

Results and Discussion

Induced systemic resistance in chickpea against *Fusarium* wilt disease was studied by treating the seeds, by two methods i.e. soaking and dressing, with SA, Bion and K_2HPO_4. Disease appeared in two stages i.e., early wilt during the month of October and November and then late wilt during the month of March and April.

Reduction in disease was observed with both type of application but seed dressing was found more effective than soaking method. Reduction in early wilt incidence in case of seed dressing is more prominent than late wilt incidence. Highest reduction, 63% in wilt disease was observed with Bion dressing followed by 40% in SA. However, K_2HPO_4 showed 30% reduction in the disease (Fig. 1). Bion and SA showed 41 and 24% reduction in the disease respectively, when seed were soaked in the respective chemicals but no reduction in disease was found in K_2HPO_4 soaking treatment (Fig. 2). These results are comparable with our earlier findings with Bion and SA in chickpea under growth room studies, where 66% reduction was observed with these chemicals (Sarwar *et al*., 2005). Saikia *et al*., (2003) also reported that SA stimulated systemic resistance in chickpea against *Fusarium* wilt and reduced the disease 23-40 % with 40 & 80 μg mL^{-1} of SA through root application. In the other host-pathogen studies, Bion has been reported the best among other elicitor tested in tomato against several bacterial and fungal pathogens (Inbar *et al*., 1998); and in cotton against *Verticillium* wilt (Colson-Hanks *et al*., 200). It was also reported that BTH (Bion) induced the expression of several pathogenesis related proteins genes in apple seedlings against fire blight (Maxson-Stein, 2002).

A significant increase in vegetative growth was observed visually with all the treatments but an increase in yield was found non significant (Table 1). However, effect of induction treatments on chickpea yield was not comparable with the degree of reduction of disease which may be explained that vegetative growth was increased by induction of systemic resistance in chickpea by SA and Bion as reported earlier (Saikia *et al*., 2003; Sarwar *et al*., 2005). Reduction of disease incidence in chickpea may be associated with induction of phytoalexins (Kuc, 2006) and pathogenesis-related proteins, chitinase and β-1,3- glucanase. Purified chitinase and β-1,3- glucanase also exhibited antifungal activities against FOC *In vitro* (Saikia *et al*., 2005), which indicated that PR-proteins had direct effect on the growth of pathogen. Present findings suggest that Bion and SA could induce systemic resistance in chickpea against *Fusarium* wilt disease and seed dressing is the best and practicable method of application in the field.

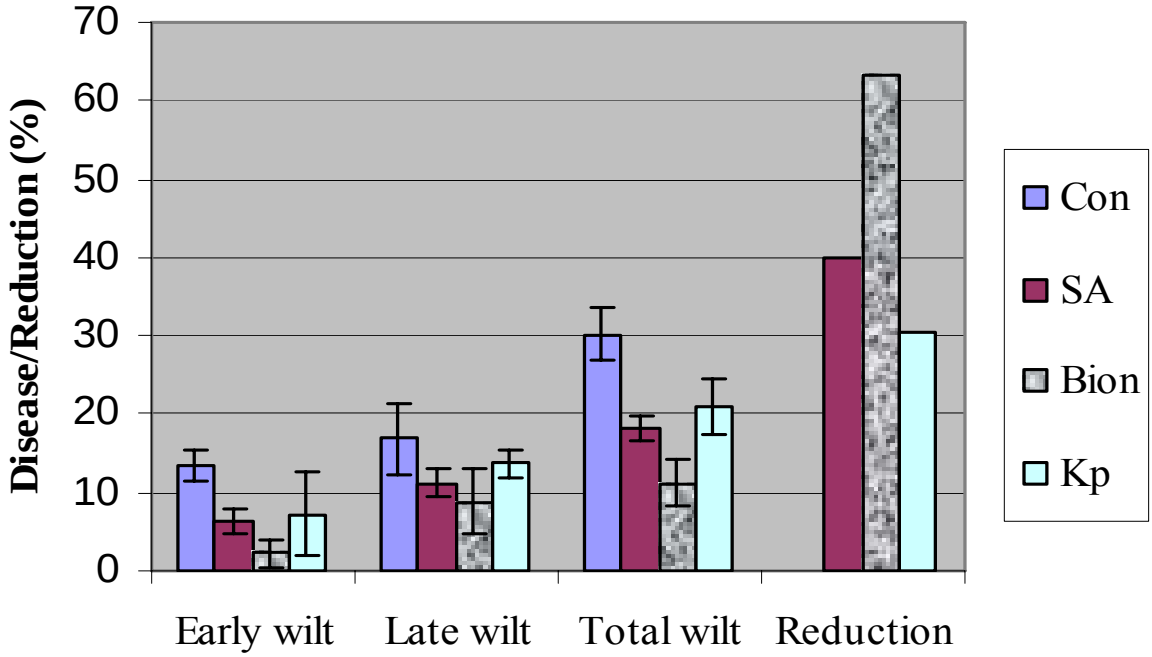

Fig. 1. Effect of seed dressing with different chemicals on wilt disease incidence in chickpea growin in wilt sick field. Chickpea seeds were dressed with Salicylic (SA), Bezo (1,2,3)-thiadizole-7-carbothioic acid –S- methyl ester (Bion), K_2HPO_4 (Kp) and water (Con) for two hours before sowing.

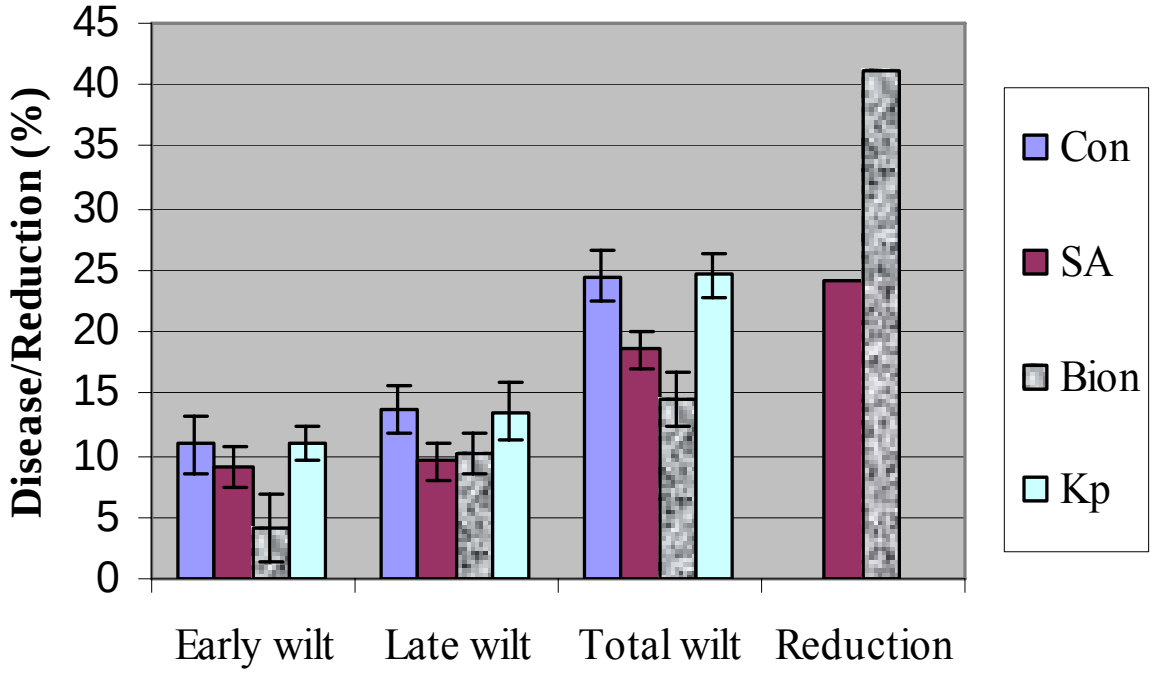

Fig. 2. Effect of seed soaking with different chemicals on wilt disease incidence in chickpea growin in wilt sick field. Chickpea seeds were soaked in aqeous solutions of Salicylic (SA), Bezo (1,2,3)-thiadizole-7-carbothioic acid –S- methyl ester (Bion), K_2HPO_4 (Kp) and water (Con) for two hours before sowing.

Table 1. Chickpea yield in small plot (2x5 meter) in wilt sick field after induction of systemic resistance by different chemicals.

Treatments	Seed soaking (Kg/ plot)	Seed dressing (Kg/ plot)
Control	1.40 ± 0.44 [a)]	1.48 ± 0.21[a)]
Salicylic acid	1.67 ± 0.53	1.71 ± 0.33
Bion	1.75 ± 0.37	1.80 ± 0.27
K_2HPO_4	1.68 ± 0.27	1.65 ± 0.24

a) Average of three replicate ± Standard Deviation

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