International Journal of Forestry and Crop Improvement
Volume **8** | Issue 2 | December, 2017 | 121-124 | ■Visit us : *www.researchjournal.co.in*
e ISSN-2230-9411

RESEARCH ARTICLE

DOI: 10.15740/HAS/IJFCI/8.2/121-124

Impact of green crop residues on Fusarium wilt incidence and growth parameters of the gladiolus

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ABSTRACT : The field experiment was conducted at experimental farm of the Department of Plant Pathology, Dr. YS. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the period 2014-2015. Different green crop residues *viz.*, marijuana (*Cannabis sativa*), mustard (*Brassica rapa*), peas (*Pisum sativum*), cabbage (*Brassica oleracea*), pumpkin (*Cucurbita pepo*), barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*) were incorporated into the soil and evaluated against the Fusarium wilt, germination of bulbs and other growth parameters of the gladiolus. The soil beds amended with cabbage leaves residue showed the minimum disease incidence (11.97%) which was followed by the mustard *i.e.* 19.02% when compared with control (42.06%). These green crops amendment treated bed also shows increase in germination percentage, bulb number bulb weight, spike length and number of flower in spike. Beds amended with cabbage leaves residues shows highest germination of the gladiolus bulbs (92.44%), maximum number of flower in spike (14.67), longest spike (56.33) and maximum number of the bulb (15) as compare to the control. It also has better bulbs germination, plant growth, increased spike length, maximum flower in spike, increase weight and number of bulbs.

KEY WORDS : Gladiolus, Green crop residue, Fusarium wilt, Germination

HOW TO CITE THIS ARTICLE : Chandel, Sunita and Kumar, Vijay (2017). Impact of green crop residues on Fusarium wilt incidence and growth parameters of the gladiolus. *Internat. J. Forestry & Crop Improv.*, **8** (2) : 121-124, **DOI: 10.15740/HAS/IJFCI/8.2/121-124.**

ARTICLE CHRONICAL : Received : *23.10.2017;* Revised : *05.11.2017;* Accepted : *23.11.2017*

INTRODUCTION

Gladiolus (*Gladiolus grandiflora* L.) is an herbaceous and one of the most cultivated, economically important and common flowering plants worldwide including India. It is native to South Africa and has been cultivated globally. The major gladiolus producing countries are the United States, Holland, France, Poland, Italy, Bulgaria, Brazil, Australia, Israel and India. The name gladiolus is derived from the Latin word "gladius" meaning sword from the shape of its leaves. Gladiolus (*Gladiolus* spp.) belongs to the family Iridaceae and subfamily Ixioideae (Ranjan *et al.*, 2010). The genus Gladiolus comprising 255 species (Goldblatt and Manning, 1998) is a very popular bulbous commercial flower. Gladioulus is known as queen of the bulbous plants and

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is very popular as a cut flower, both with the consumer and the florist alike because of its many spike forms, colours and colour combinations, an advantage in every floral arrangement (Bushman, 1990). It is known for its beautiful spikes as well as long vase life (Bose *et al.*, 2003). The magnificent long-lasting spike of gladiolus come in a variety of colours and forms which makes it more attractive for use in herbaceous borders, bedding rockeries, pots, as well as cut flowers (Parthasarathy and Nagaraju, 1999).

A number of fungal, bacterial and viral pathogens attacks the gladiolus cause the diseases such as Fusarium wilt, core or spongy rot, dry or neck rot, Curvularia blight, bacterial scab, grey mould, storage rot etc. The diseases specially caused by fungal pathogens, causes heavy damages in terms of plant stand, quality and yield (Protsenko, 1958; Vlasova and Shitan, 1974 and Chandel and Bhardwaj, 2000). Among the fungal diseases the Fusarium wilt is the most devastating and caused by four species of Fusarium namely, *F. oxysporum* f. sp. *gladioli* (Massey) Snyder and Hansen, *F. solani, F. moniliforme* and *F. roseum*. The wilt inciting fungus, *Fusarium oxysporum f. sp. gladioli* has the widest world distribution (Buxton and Robertson, 1953) and it can survive in infected corms and soil as mycelium, clamydospores, microconidia and macroconidia. In India, gladiolus wilt caused by *F. oxysporum f. sp. gladioli* was first recorded by Singh (1969) from Uttar Pradesh. Fusarium yellows is considered a serious and highly devastating disease which causes 60-70% plant mortality (Vlasova and Shitan, 1974).

In the present study, the attempts have been made to control the Fusarium wilt disease with green crop residues and to see the improvement in the germination of bulbs and growth parameters of the plant such as, spike length, flower in spike, number and weight of bulbs. The green crop residue which were used as such were marijuana (*Cannabis sativa*), mustard (*Brassica rapa*), peas (*Pisum Sativum*), cabbage (*Brassica oleracea*), pumpkin (*Cucurbita pepo*), barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*).The green leaves of the above cited crops were collected from the farms and were mixed homogenously in the soil after chopping into small pieces 20 days prior to sowing of the gladiolus bulbs. The continuous use of fungicides proved to be hazardous; polluting the environment and leading to residual toxicity, creating resistance in pathogens and reducing soil fertility (Riaz *et al.*, 2008; Nazir and Riazuddin, 2008). Therefore, the present investigation was carried out to evaluate the different crop residue as cultural methods for controlling the diseases and so that there is less dependence on the fungicides (chemical) uses in the future.

EXPERIMENTAL METHODS

Experiment on the evaluation of different green crop residues was carried out at the experimental farm, Department of Plant Pathology, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh, India. Beds for planting of gladiolus were prepared by proper mixing of soil with the chopped green crop residue crops. The green manure crops which were used are as follows marijuana (*Cannabis sativa*), mustard (*Brassica rapa*), peas (*Pisum Sativum*), cabbage (*Brassica oleracea*), pumpkin (*Cucurbita pepo*), barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*). The experiment was laid out by following a Randomized Complete Block Design (RBD) with eight treatments including control and replicated thrice in $1x1m^2$ plots. All the cultural practices *i.e.*, irrigation, hoeing, weeding, spraying and fertilizer application was given in time during the entire growth period for obtaining better results. The following parameters were studied diseases incidence, germination of bulbs, spike length, number of flower in the spike, number of bulbs and weight of bulbs. Statistical analysis was done with using the standard procedure described by Gomez and Gomez (1986).

EXPERIMENTAL RESULTS AND ANALYSIS

In the present investigation, out of the different green crop residues used for managing Fusarium wilt of gladiolus mustard (*Brassica rapa*) and cabbage (*Brassica oleracea*) found superior to rest of the treatments. The effect of the green crop residue on the germination of bulbs and on other growth parameters such as spike length, flower in spike, number and weight of bulbs also ascertained. It is clear from the data presented in the Table 1 that the minimum (11.97%) diseases incidence was recorded in the beds amended with cabbage, followed by the mustard (19.02%). Irrespective of the cabbage and mustard, other beds amended with different crop residues show significantly better results in treatments such as wheat (20.74%), barley (22.10%),

marijuana (23.54%), peas (27.17%) and pumpkin (30.03%) in comparison to control where per cent disease incidence was recorded to be 42.0. The beds which were amended with the cabbage leaves residues also shows the maximum (92.44%) germination of the bulbs, followed by mustard (83.51%) wheat (75.11%), barley (71.88%), marijuana (74.92%), peas (62.89%) and minimum germination was observed in beds amended with pumpkin (51.95%) when compared with control (60.11%).

It is evident from the data presented in the Table 2 that the beds amended with the cabbage shows maximum increase in growth parameter *viz.*, flower length (56.33 cm), flower number in spike (14.67), bulb number (15) and bulb weight (640 g), respectively followed by the mustard where flower length (44.66 cm), flower number in spike (11.67), bulb number (12.33) and bulb weight (503 g) got improved. There is decreasing rate of growth parameters found in beds amended with pumpkin *viz.*, flower length (41.67 cm), flower number in spike (9), bulb number (7) and bulb weight (173 g) as well as untreated plots kept as control.

The results of the field trails revealed that the all the beds amended with the crop residues show the significant decreases in the Fusarium wilt diseases incidence, increase in the germination of the bulbs and increase in other growth parameters. Maximum control of disease incidence against Fusarium wilt was recorded in the treatment with cabbage; similar results were obtained by the Villapudua and Munnecke (1987) to control cabbage yellow's disease and Iriarte *et al.* (2011) to control soil borne *Fusarium oxysporum* pathogen. Mustard was found effective against the Fusarium wilt

Table 1 : Effect of the green crop residues on the germination percentage and Fusarium wilt disease

Green crop residues	Germination (%) plots	Disease incidence (%)	Mean
Marijuana (*Cannabis sativa*)	74.92 (59.92)	23.54 (29.08)	49.22 (44.46)
Mustard (*Brassica rapa*)	83.51 (66.02)	19.02 (25.84)	51.26 (45.93)
Peas (*Pisum sativum*)	62.89 (52.45)	27.17 (31.40)	45.03 (41.92)
Cabbage (*Brassica oleracea*)	92.44 (74.04)	11.97 (20.22)	52.21 (47.13)
Pumpkin (*Cucurbita pepo*)	51.95 (46.10)	30.03 (33.21)	40.99 (39.65)
Barley (*Hordeum vulgare*)	71.88 (57.96)	22.10 (28.03	46.99 (42.99)
Wheat (*Triticum aestivum*)	75.11 (60.05)	20.74 (27.08)	47.92 (43.56)
Control	60.11 (50.81)	42.06 (40.41)	51.08 (45.61)
Mean	71.60 (58.42)	24.58 (29.40)	
Effect	C.D. (P=0.05)		
Green manure (GM)	1.20		
Germination and disease incidence (GDI)	1.81		
GM x GDI	2.58		

Table 2 : Effect of the green crop residues on the various growth parameters of the gladiolus plant

Green crop residues	Flower length (CM)	Flower number	Bulb Number	Bulb weight (g)	Mean
Marijuana (*Cannabis sativa*)	45.00	9.66	9.00	243.33	76.75
Mustard (*Brassica rapa*)	44.66	11.67	12.33	503.33	142.95
Peas (*Pisum sativum*)	50.66	11.67	10.33	433.33	126.50
Cabbage (*Brassica oleracea*)	56.33	14.67	15.00	640.00	181.50
Pumpkin (*Cucurbita pepo*)	41.67	9.00	7.00	173.33	57.75
Barley (*Hordeum vulgare*)	48.00	10.67	8.67	236.67	76.00
Wheat (*Triticum aestivum*)	52.33	11.33	8.00	253.33	81.25
Control	46.67	9.67	6.67	186.67	62.41
Mean	48.17	11.04	9.08	333.75	
Effect	C.D. (P=0.05)				
Green manure (GM)	1.20				
Growth parameter (GP)	3.47				
GM x GP	8.95				

of the gladiolus next to the cabbage (Sintayehu *et al.*, 2014 and Garibaldi *et al.,* 2010). It was recorded that treatment with cabbage and mustard, there is increase in germination of bulbs, increase in spike length, number of flower in spike; number and weight of bulbs except for the treatment with pumpkin which shows the diminishing rate.

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