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Effects of fertilizers on incidence of damping-off in nursery of flue cured virginia cv. speight g-28

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ABSTRACT

Tobacco is an important cash crop which is affected by different diseases in different stages of life cycle. For the control of these diseases different pesticides are used. In the present study, Speight G-28 of FCV (Flue Cured Virgin) was grown in the experimental beds to evaluatethe effect of different fertilizers (i.e., Di Ammonium Phosphate, Ammonium Nitrate, Nitrophas, Super Phosphate, FYM and control) on the incidence of damping-off disease in tobacco nursery. Results showed the maximum disease was occurred in FYM (Farm Yard Manure) treated beds followed by super phosphate and the minimum disease were reported in DAP (Di Ammonium Phosphate) treated beds and followed by Nitrate. FYM was the primary source of infection causing damping-off disease. It was known that for the control of damping off disease there were many factors which were correlated to each other e.g. temperature, moisture, and soil nutrient. It was also observed that no seedlings were emerging in bed containing urea fertilizer due to ammonia gas formation which suppresses the seeds to germinate.

Key Words: *Speight G-28, Damping-off, Fertilizers and Ammonia gas*

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I. Introduction

Tobacco is an annual growing plant with tap root system. Tobacco produces large amount of seeds, which are greatly minute in size. It is one of few crops, enjoying world trade entirely on its leaf basis and the most widely grown commercial non-food plant in the world (Shah et al., 2008). Only two species;*N. tobaccum* and *N. rustica* are grown on large scale all over the world. The *N. tobaccum* is mainly used for the purposes of cigarettes, cigar and bidis manufacturing whereas *N. rustica*is used for snuff, local Hakka and chewing purpose (Gupta et al., 1998).Realizing the importance of tobacco in strengthening the national economy, Pakistan took effective reformer steps since 1948 for promoting tobacco cultivation, quantity and production. Flue cured virgin has the popular names are Virginia or

cigarette tobacco. Chemical composition having 1.3-2.5% nicotine, 9.0-16.0% reducing sugar and 0.75-0.90% chloride (Benowitz and Jacob, 1986). FCV is mostly using in cigarette due to 1/6 ratio of nicotine and sugar, which is required for good quality cigarette. Speight G-28 was chosen to conduct this work because this is the most grown variety of FCV in Mardan on the recommendation of PTB due to its high yield capacity, high sugar and low nicotine contents, resistant to black shank, and bacterial and *Fusarium wilt* and producing a few ground suckers. FCV tobacco is mainly cultivated in Pakistan and commonly industrialized as a cigarette making. FCV production is increase from 23.8 million Kg in 1967-68 to 105,000 tons in 2009. In FCV production, Pakistan is now the 7th rank in the world (www.ptc.com.pk). Tobacco plant is subjected to disease and decays from the day seed is sown till the time it enters into the factory. Damping-off of young plants caused by the number of soil born fungi, like *Rizocotonia, Pythium, Fusarium, Phytophthora*. In damping-off disease, plants are affected in young stage especially seeds, germinates and plantlets of different species including woody plants. The disease is produced in two stages viz.In pre-emergence damping-off, the infection takes place at an early stage during sprouting and the tiny seedlings die before emergence (Devaki et al., 2000). In Pre-emergence, the disease is much more rigorous and difficult to diagnose because the infected young plants are very tiny and invisible but it concern the germination rate of seeds (Baker, 1957). In post-emergence damping-off, the infection appears after emergence of seedlings when the decay of the collar region of the seedling started near the soil level and extending towards the leave and roots. There are numerous important factors which affecting the quality and yield of any crop. Crops required high quality of seeds variety, proper irrigation, modern techniques, and plant nutrient. The soil nutrients affect different physiological process including growth and hence yield and its quality. It is now known that at least 16 plant-food elements are necessary for the growth of the green plants. Fertilizers include all those substance which provide nutrient and increase soil fertility (Hajra, 2001). The effective dose of fertilizer increase 30-80 percent plants yield and improve the food and fodder quality. Many limiting factors which effect the plant growth fertilizer remove the limiting factor in soil and improve the plant growth. Effect of soil nutrients on disease has also been studied. It has been reported that high nitrogen level increased the susceptibly to many disease affecting the green part of the plant (Dordas, 2008) while phosphorus and especially potassium make the plant more resistance to fungal pathogen (Smith & Bandara, 2002). Nutrient element can affect disease severity by altering the inoculums potential or virulence of the pathogen or by changing the resistance of the host of the pathogen (Datnoff et al., 2007). Potassium has not been shown to be a constituent of any stable compound, but act as mobile element which is involved in enzymes activities and membranes, protein and carbohydrates metabolisms. It has been shown that imbalance in this element has the potential to alter the host metabolism and impair is ability to respond pathogen invasion (Smith & Bandara, 2002). Fertilizer is a basic thing for the plants development and physiological processes. Raising healthy and vigorous seedlings, available in sufficient quantities at the time of transplantation, is the prerequisite for raising a healthy and successful tobacco crops. In tobacco nursery, the effects of six fertilizer like super phosphate, urea, DAP, ammonia, nitrophas and farm yard manure (FYM) was studied.

II. Materials and Methods

The research was conducted at Tobacco Research Station, Mardan, Pakistan. Speight G-28 variety of FCV was grown in experimental beds to study the effect of different fertilizer on the incidence of damping off in tobacco nursery. Twenty one beds measuring 1m×1m was prepared to be used as experimental plots. To make the soil soft and porous the plots were first dug out with the help of hoe up to about 1/2 ft depth. Bulky soil aggregates were broken and soil was thoroughly mixed. Surface of each plot was leveled with hands. Six fertilizers Superphosphate (Tara fertilizer limited Multan), Urea (SonaPoje Fertilizer Limited Multan), Nitrate (Pak Arab Fertilizer Limited Multan), Nitrophas (PAFLM), FYM, DAP (Sona DAP) were used at the rate of 100g per plot. For each fertilizer, three replicates were taken and three beds were left without using any fertilizer to be used as control for the purpose of comparison. Seed of Speight G-28 variety having a germination rate of 74.19% were sown in each plot on December 12, 2010. In order to evenly distributes the seed on the surface of the beds. They were first mix with sand and then spread over the surface as practice by the farmers. The seed beds were watered (3L/bed) at the interval of two days till the time of transplantation. Due to the diffusion of water from surrounding soil on the rainy days the plots were not routinely watered , rather water was given when its need were felt. Transparent plastic cover were used to maintaining enough high temperature and moisture on beds necessary for seedling growth as well as protect

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seedling form the frost. To avoid direct contact between plastic cover and seedlings, the plastic cover was supported with sticks bended in the form of arc and fixed with their sides of the beds. Plastic cover was removed daily at dawn and was put again at dusk. On the rainy day the cover was not removed at all. Weeds, when appeared were eradicated by rooting them out with the help of hands or forceps. Generally weed eradication was performed after watering the beds so us to avoid any damage to tobacco seedling. Data were collected till transplantation at an interval of eight days. Each time diseased and healthy plants were counted and the data was noted as percentage of diseased plants in each plot. Data was analyzed using Duncan multiple test to known whether the difference between the means of data were significant or not.

III. Results and Discussion

Speight G-28 variety of the flue cured tobacco was grown at the Tobacco Research Station, Mardan. To investigate the effects of different fertilizers in nursery condition on damping-off disease of Speight G-28 variety, five fertilizers i.e. Super Phosphate, DAP; Ammonia Nitrate, Nitrophose and FYM were used at the rate of 100g per 1×1m bed. These fertilizers were used in granular form at the time of preparation of beds and before sowing of the tobacco seeds. Incidence of Damping-off varied from fertilizer to fertilizer which indicates the impact of the fertilizers on the disease susceptibility or resistance toward damping-off of this variety (Table 01). Perusal of data revealed significant difference in the incidence of damping-off among different fertilizer treatment and control. The mean percent values of disease incidence ranged from 0.167 to 19.19 with application of DAP and FYM respectively. Maximum average disease incidence was recorded withthe application FYM. Completely failure of germination in urea treated beds might be due to more concentration and ammonia gas formation during ammonification and nitration, which have affected the seeds before sprouting and so there was no emergence of seedling (Dawar & Ghaffar, 1999). Nitrogen and phosphorus containing fertilizer were used. It was revealed that unbalanced nutrients level in soil were more susceptibleto diseases. It would seem logically that the thin-walled, immature un-lignified cells were produced in unbalanced condition which is more readily entered and destroyed by the pathogen than the thick-walled and mature lignified cell which was produced in balanced condition of nutrients (Sumith & Bandara, 2002). Altering nutritional state of the soil can have an effect on the severity of soil born plant disease. It had been foundthat enhanced level of nitrogen increase susceptibility to many diseases, affecting the green parts of the plants (Abro et al., 2014). While high levels of phosphorus and potassium make plants resistant to fungal pathogen (Smith & Bandara, 2002).

Farm yard manure (FYM)

Rate of damping-off in FYM, with its mean value 19.19% was significantly higher than the control (Table 01). The percentage of disease varied over the period from emergence till time of transplantation. Minimum disease was observed when the plantlets were 10-28 days older whereas, the rate of incidence enhanced at the age of 27-41 days. The ratio of disease had decreased at the age of 67 days indicating that the older seedling were less susceptible to damping-off than the younger one. An increase in disease at the age of 27-41 days might possiblydue to rainy season that cause high humidity in turn would have the disease in the greatest rate. FYM contains sufficient amount of plant food nutrients and improves soil texture, structure and water holding capacity due to which emergence of the seedlings was easy and the most of the seed got germination with a dense population. High density of seedling cause poor air circulation and increased humidity ultimately encourage damping-off in FYM treated plots. It has been reported previously that high levels of FYM in soil enhanced susceptibility of cauliflower plant to stem rot pathogen (Waller et al., 2007). Jiskani et al. (2007) had also been reported that damping-offrapidly developed in the seedling stage, particularly in rainy season and high humidity. However, the disease is mostly affected by rainy days and high temperature. The mean valve of FYM is higher than control due to high rate of plants germination in FYM (Figure 01 & Picture 02).

Super phosphate

Phosphatic fertilizers helped in the root development and counteract the harsh effects of the excess nitrogen. The application of super phosphate had enhanced the root development and soil conditions. Itenhanced the rate of seed germination (100%) that caused dense seedling. The incidence of the

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disease had been enhanced due to dense seedling and plastic covering because; these factors are responsible for high humidity which favor the conditions for damping off (Table 01). Similar results were presented by Kauserud et al. (2008). In young stage when the seedling were 10-28 days old low disease were recorded and could be considered as incubation periods of pathogen. In super phosphate the mean valve was 16.32 which were higher than control, nitrate and DAP but lower than FYM indicating dense population of seedling (Figure 02 & Picture 03).It was found that due to high seedling densities the disease was transmitted readily between host plants but in lower densities the greater distance between adjacent plants reduce the probability of successful transmission. It was suggestedthat disease was more severe in dense population of plants (Jurke & Fernando, 2006).

Diammonium phosphate (DAP)

The results revealed that DAP had positive effect on seedlings and the disease incidence was lowest (Table 01). The lowest disease incidence might be due to the reason that during ammonification some of the seedlings had been affected and were destroyed.The remaining seedlings were cultivated and each seedling had sufficient space and aeration with low humidity. They got two of the main macro-nutrients and flourished well, having healthy environment and thus low chance of damping-off to occur. The disease occurred in young stage due to low immunity of the plant seedling. The DAP had lower disease incidence than control. These results are confirmed by the results of Sumith & Bandar (2002) who, reported that in balance nutrient condition the disease incidence was very low and imbalance nutrients may aggravate the disease incidence (Figure 03 & Picture 04).

Nitrophos

It was further evident (Table 01) that the lowest disease incidence 1% was observed due to the application of the ammonium nitrate followed by nitrophos with 5% disease incidence. In these plants the severity of the disease had decreased at young stage due to the fact that in these plots the germination percentage had reduced due to which the plants were less dense. This low percentage of disease was due cloudy and rainy season during which the beds were covered by plastic all time (Figure 04 & Picture 05).

Nitrate

Plots received the treatment of nitrate showed decrease in germination percentage. This decrease was due to the fact that some of the seedlings had been damaged due to ammonification and nitration. The seedling population was adequate, no humidity was developed and the space, food and the aeration were favorable for plant growth. Nitrate had low disease incidence as compared to control. Span & Schumann (2010) reportedthat ammonium nitrate was toxic to *Fusarium* and *Phytoptophore* species. Disease percentage was low because some of the damping-off causing fungi had been killed by ammonium nitrate. Ammonium nitrate is formed from ammonium nitrogen in the nitrogen cycle as it is converted to nitrate by beneficial bacteria (Figure 05 & Picture 06).

Table 01. Effect of different fertilizers on the incidence of post-emergence Damping-offin tobacco nursery cv. Speight G-28

S. No.	Treatments (Fertilizers)	Means of the % age of diseased plants
1	Control	8.87^{ab}
2	Farm yard manure	19.19^{c}
3	Super phosphate	16.32^{bc}
4	Di ammonia phosphate	0.17^{a}
5	Nitrophos	5.34^{a}
6	Ammonium nitrate	1.09^{a}

Means with different superscript are significantly not different from each other.

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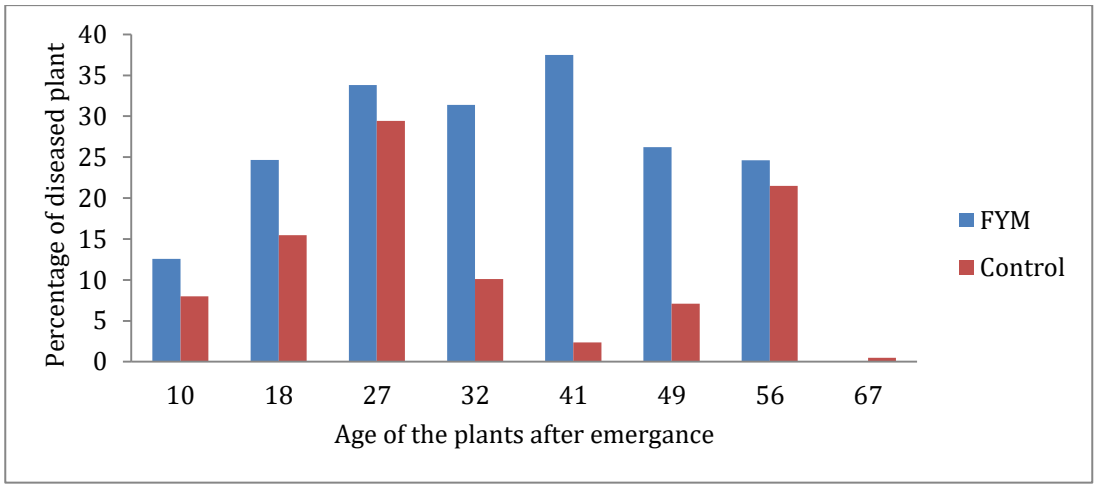

Figure 01. Effect of FYM on incidence of damping-off in Speight G-28 variety of FCV.

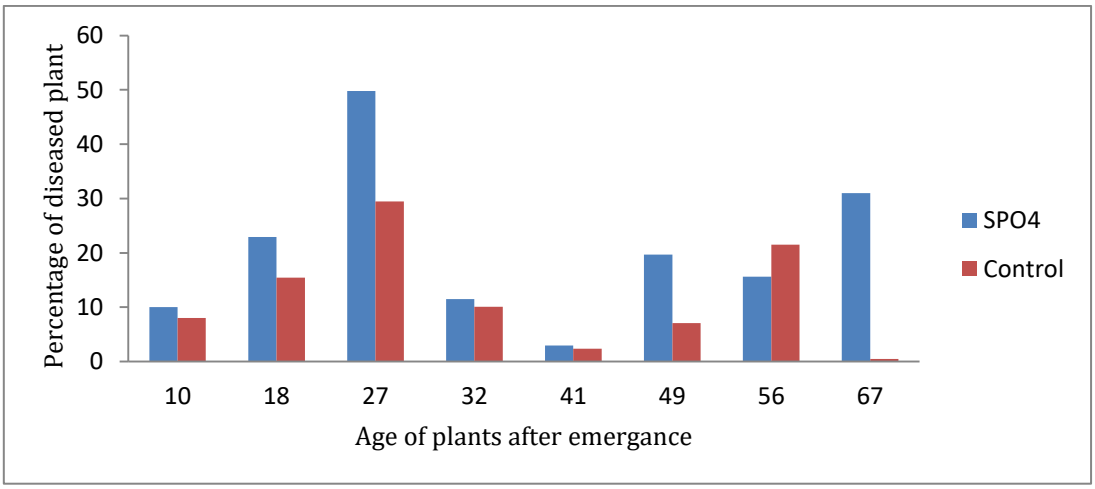

Figure 02. Effect of Super phosphate on incidence of damping-off in Speight G-28 variety of FCV.

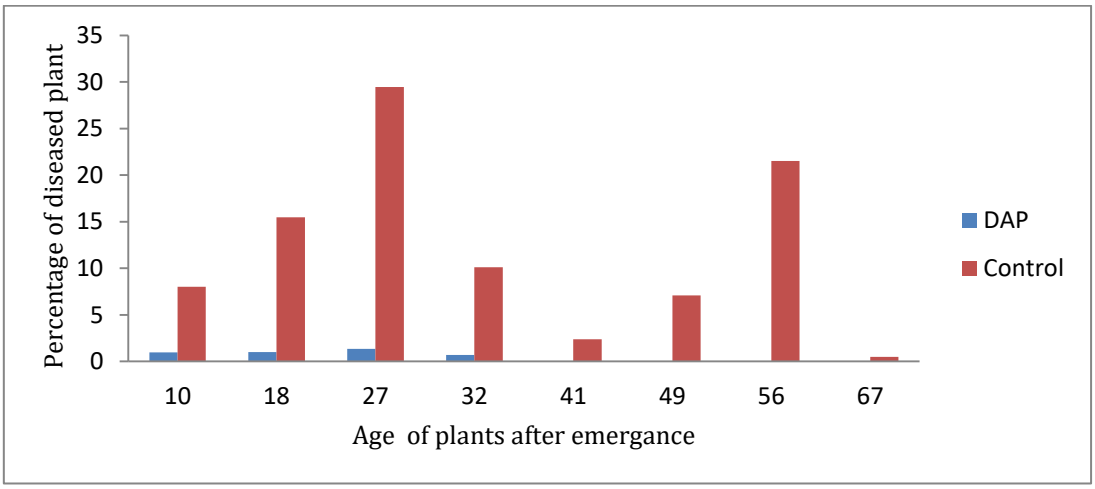

Figure 03. Effect of DAP on incidence of damping-off in Speight G-28 variety of FCV tobacco.

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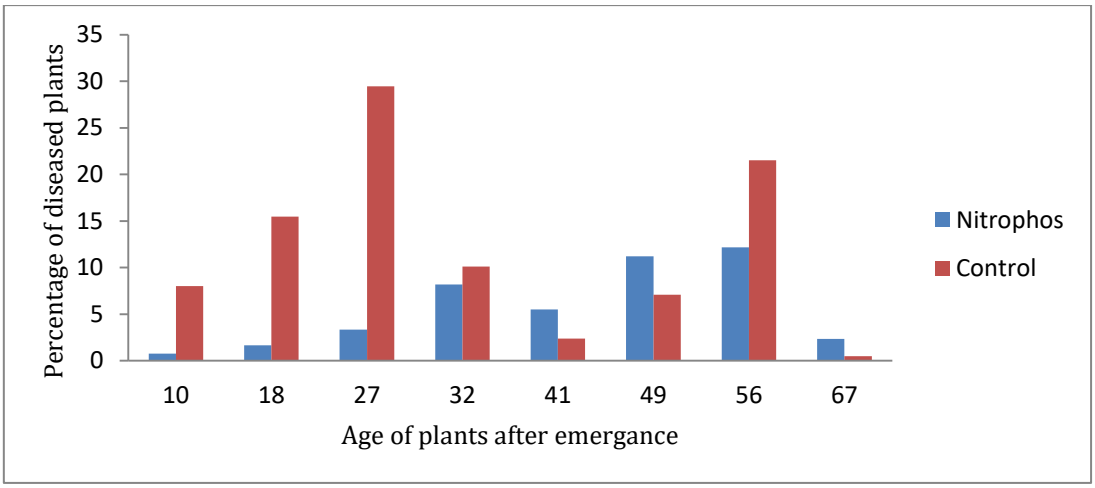

Figure 04. Effect of Nitrophos on incidence of damping-off in Speight G-28 variety of FCV.

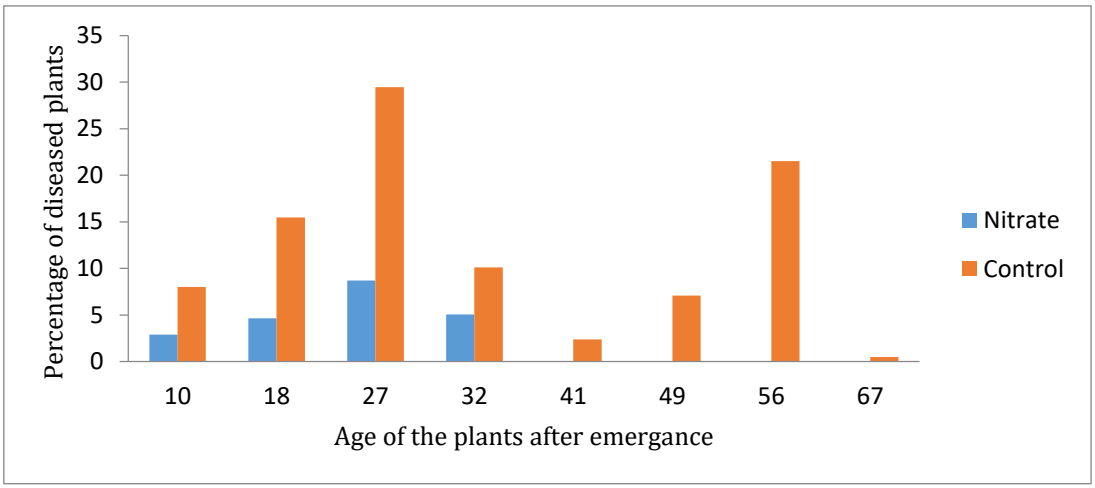

Figure 05. Effect of ammonium nitrate on incidence of damping-off in Speight G-28 variety of FCV.

Picture 01. Beds of tobacco seedlings is protected in plastic cover.

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Picture 02. Effect of FYM on incidence of damping-off in Speight G-28 variety of FCV.

Picture 03. Effect of Super phosphate on incidence of damping-off in Speight G-28 variety of FCV.

Picture 04. Effect of DAP on incidence of damping-off in Speight G-28 variety of FCV tobacco.

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Picture 05. Effect of Nitrophos on incidence of damping-off in Speight G-28 variety of FCV.

Picture 06. Effect of ammonium nitrate on incidence of damping-off in Speight G-28 variety of FCV.

IV. Conclusion

There are many factors (temperature, moisture and soil nutrients) that are responsible for damping-off disease. All these factors are correlated to each other so, in order to control the disease all the factors should be addressed simultaneously.

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