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EFFECT OF SEED DRESSING CHEMICALS ON EMERGENCE, YIELD AND AGAINST SOIL & SEED BORN DISEASES OF WHEAT

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A B S T R A C T

Field studies were carried out at Adaptive Research Farm, Sheikhupura Punjab, Pakistan having rice- wheat cropping system to evaluate the efficacy of three different fungicides against seed or soil borne wheat diseases (Root rot, Loose smut & Black Point disease) during two successive seasons 2015-16 & 2016-17.The fungicides were Thiophenate methyl, compound fungicides i.e. Tubeconzol+ imidachloprid and Difenoconazol + cypnoconazol used as seed treatment @ 2.5 g , 4.0 ml & 1.0 ml per kilogram of seed respectively. Incidence of root rot, loose smut & black point disease was recorded by selecting 15 plants, 100 plants & 100 seeds randomly of each treatment from each plot respectively in comparison with untreated control. All the fungicides significantly increased the seedling emergence per square meter about 15 percent as compared to untreated plot. Tubeconzol+ imidachloprid and Difenoconasol +cypnoconazol were the most effective seed dressing fungicide and reduced the number of rotted roots, loose smut infected spikes and black point infested seeds. Maximum number of productive tillers per square meter, healthy grains per spike and yield kg per hectare were recorded with compound fungicide Tubeconzol+ Imidachloprid followed by Difenoconazol + Cypnoconazol treated plots as compared to untreated plot.

Keywords: Wheat, seed treatment, germination, yield, yield components

INTRODUCTION

Wheat (*Triticum aestivum* L.) is considered as staple food by two third of the world population and the most important cereal crop (Majumder, 1991). It is the key crop of Pakistan because it is used as the main source of human food and the straw is also used for industrial product as well as feed for livestock. It meets the major nutritional requirements and gaining popularity all over the world and especially in Pakistan because a staple food. In Pakistan about 25492 thousand ton wheat is produced from an area about 8950 thousand hectare While in the Punjab province the area under wheat crop was 6917 thousand hectare and its production remained 19526.67 thousand ton during 2016-17 (Anonymous, 2017).

Wheat plants are exposed to many harms and stresses that creates hindrance in the growth and development at all stages. According to statement of (Razzaque and Hossain, 1991), different seed borne fungi such as *Bipolaris sorokiniana*, *Alternaria alternata*, *Curvularia lunata*, *Fusurium* spp. cause 20% yield losses in wheat. Seed is the main source for the transmission of plant pathogens that cause diseases in plant. The seed borne pathogens are associated externally or internally with

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seed as contaminant. Seed borne pathogens affect the seed in number of ways like seed abortion, seedling blight/wilting, necrosis, or reduce the germination as well as seedling emergence by systemic or local infection resulting in the development of disease at later stages of plant growth. Black point disease affects the vigour and luster of wheat grains that reduces the market value (Solanki *et al*., 2006). Black point disease caused by *Bipolaris sorokiniana* and *Alternaria alternata,* is an important seed-borne disease in many wheat growing countries of the world (Zishan *et al.,* 2005; Hasabnis *et al.,* 2006). Smiley *et al., (2013) depicted that Fusarium* spp. cause crown rot and often invade the emerging coleoptile and also reported that mostly wheat diseases are caused by fungi which attack seed, roots and foliage. Rekanović, *et al*., (2010) also stated that fungi are the major seed-borne pathogen as they render losses in a number of ways. It was stated by many authors that increased level of crop debris influence the incidence and severity of plant diseases. (Bailey & Lazarovits, 2003; Paulitz, 2006; Matusinsky *et al*., 2009). Krupinsky *et al*., (2002) reported that in the upper layer of soil there are larger microbial populations that hinder plant growth.

Seed treatment is a process that alleviates externally or internally seed borne pathogens and resulting emergence of a healthy seedling subsequently a healthy plant. Treated seeds promote good seedling establishment, lessen yield loss and to avoid further spread of pathogens. The methods of treating seeds are designed for protecting plants rather than curing them after they become diseased. It was described by Bradley *et al*., 2001; Cook *et al*., 2002 that seed treatment with fungicide is used for disease management in grain crops as positive impact on early plant growth. Galperin *et al*., (2003) also reported that a protective zone is formed by fungicides around germinating seeds and reduce diseases that caused by seed /soil-borne pathogens. Fungicidal treatment is an option to reduce primary inoculum of seed and soil-borne fungi (Ilyas *et al.,* 1998)

Under Adaptive Research zone Sheikhupura, the seedling blight, wilting at early stage of wheat crop and wheat grains were found completely or partially discloured and shriveled, it was observed at farm as well as at farmers field. Keeping in view the yield losses and problem faced by farming community of rice-wheat cropping system, a study was planned to test different fungicides as seed treatment before sowing of wheat crop. The protectants chemicals vary from crop to crop and area to area so this experiment will be supportive for the farmers in local climatic conditions, in reduction the losses in yield and improve the quality of seed.

MATERIAL AND METHODS

Studies were carried out during the two consecutive seasons 2015-16 & 2016-17 at Adaptive Research Farm, Sheikhupura. The experiment was comprised of four treatments and deliberated in Randomized Complete Block Design (RCBD) with three repeats for each treatment. The treatments were three different fungicides viz: Thiophenate methyl (Topsin-M), Tubeconzol+ Imidachloprid (Hombare) and Difenoconazol + Cypnoconazol (Dividend Star) @ 2.5 gm , 4 ml & 1 ml per kg of seed respectively and untreated control were compared to check the effect of seed dressing chemicals on plant emergence, incidence of diseases (root rot, loose smut & black point), yield parameters and grain yield under the ecological zone of Sheikhupura , Punjab , Pakistan. During the both crop season, the plot size 26 × 34 sq feet was maintained and wheat seeds of variety Galaxy-2013 were treated separately with each fungicide before sowing. Seeds were treated with the help of rotary drum and then dried seeds were sown by using hand drill. All agronomic practices like fertilizer application, weed control and other practices remained constant in all the treatments during both the year.

Data on the following parameters were noted during two consecutive crop periods:

- Plant emergence per square meter area from each plot (by square frame), number of rotted roots symptoms per15 plants that randomly collected from each plot after 18 days of sowing
- Number of spikes infected with loose smut were estimated by randomly selected 100 plants of each treatment from each plot
- Number of grains infected with black point disease for this 100 seeds were collected after harvesting and threshing and note the symptoms of black point on grains and disease incidence percentage was calculated by:

$$\text{Percent disease incidence} = \frac{\text{Number of plants infected with roots}}{\text{Total number of assessed plants}} \times 100\%$$

- Number of productive tillers in one square meter
- Plant height (average of 5 plants randomly collected from each plot).
- Healthy grains per panicle (average of 5 from each plot)
- Thousand grains weight (g)
- Grain yield Kg ha -1 were calculated at harvesting.

The parameters studied were exposed to analysis of variance and the means were compared by the least significant difference (LSD) at 0.05 probability level of significance. (Steel & Torrie, 1980).

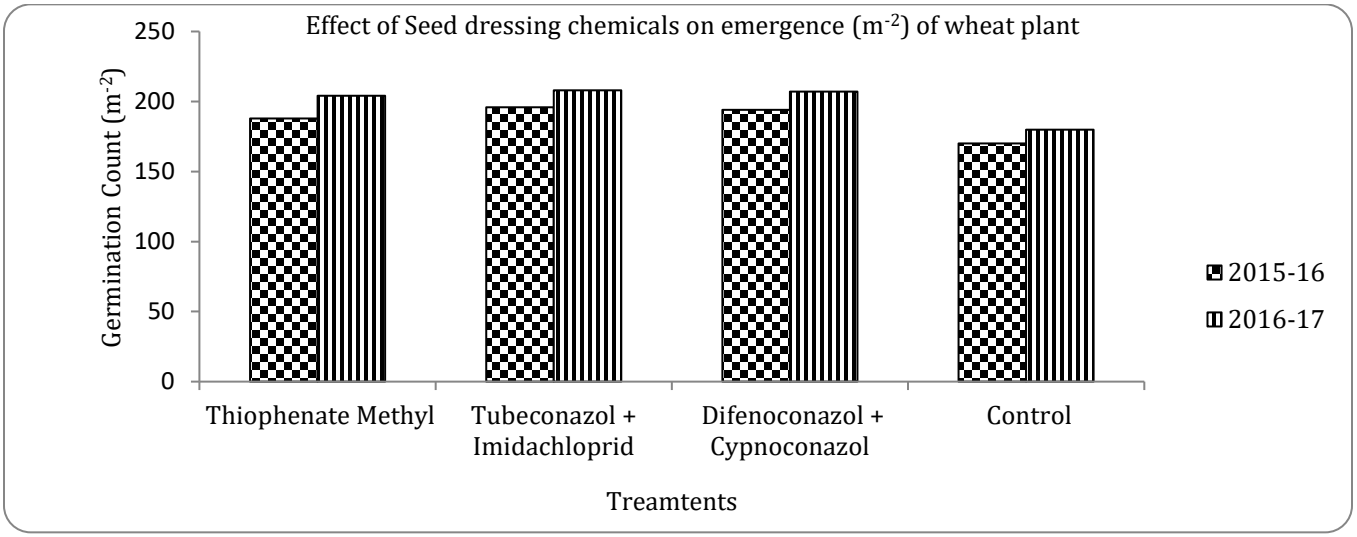
RESULTS AND DISCUSSION

Results presented in (Table 1) depict that during both the years, all the tried chemicals significantly increased the number of plants per square meter as compared with control. On the average of two seasons maximum 202 & 196 healthy wheat plants were noted from the plots treated with Tubeconazol + Imidachloprid and Difenoconazol + Cypnoconazol respectively while third one fungicide (Thiophenate methyl) showed an intermediate effect as compared with the untreated plot from where 175 wheat plants were obtained. Munkvold & O'Mara, (2002) stated that the effectiveness of seed dressing fungicides are usually evaluated by emergence percentage and used as an indication of plant vigor. Seed emergence and seedling growth has been widely accepted as main parameter to monitor growth responses it was reported by (Briggs and Dunn, 2000).

Table 1. Effect of seed dressing chemicals on emergence of wheat under field condition during two growing season.

Treatments	No. of wheat plants m^{-2}	
	2015-16	2016-17
T_1= Thiophenate Methyl	188 b	204 a
T_2 = Tubeconazol + Imidachloprid	196 a	208 a
T_3= Difenoconazol + Cypnoconazol	194 ab	207 a
T_4= Control	170 c	180 b
LSD P≤ 0.05	7.27	9.28

Means with different letters differ significantly at P≤ 0.05

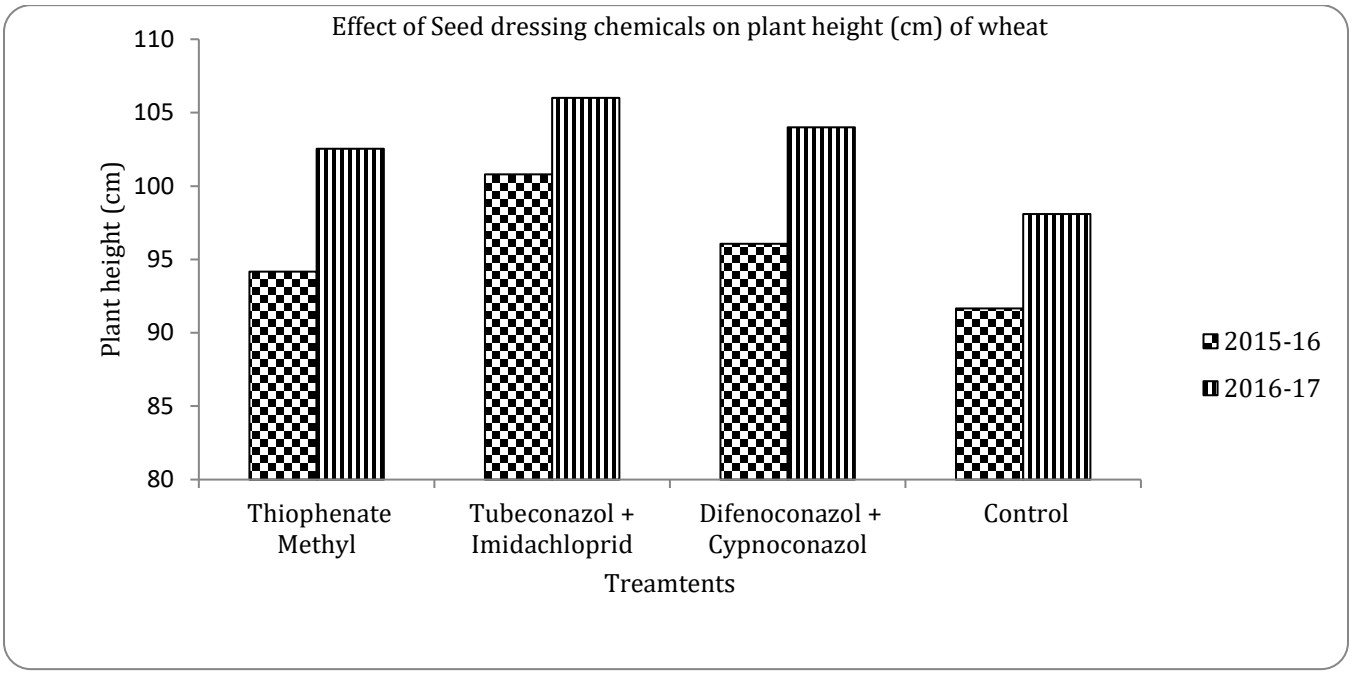


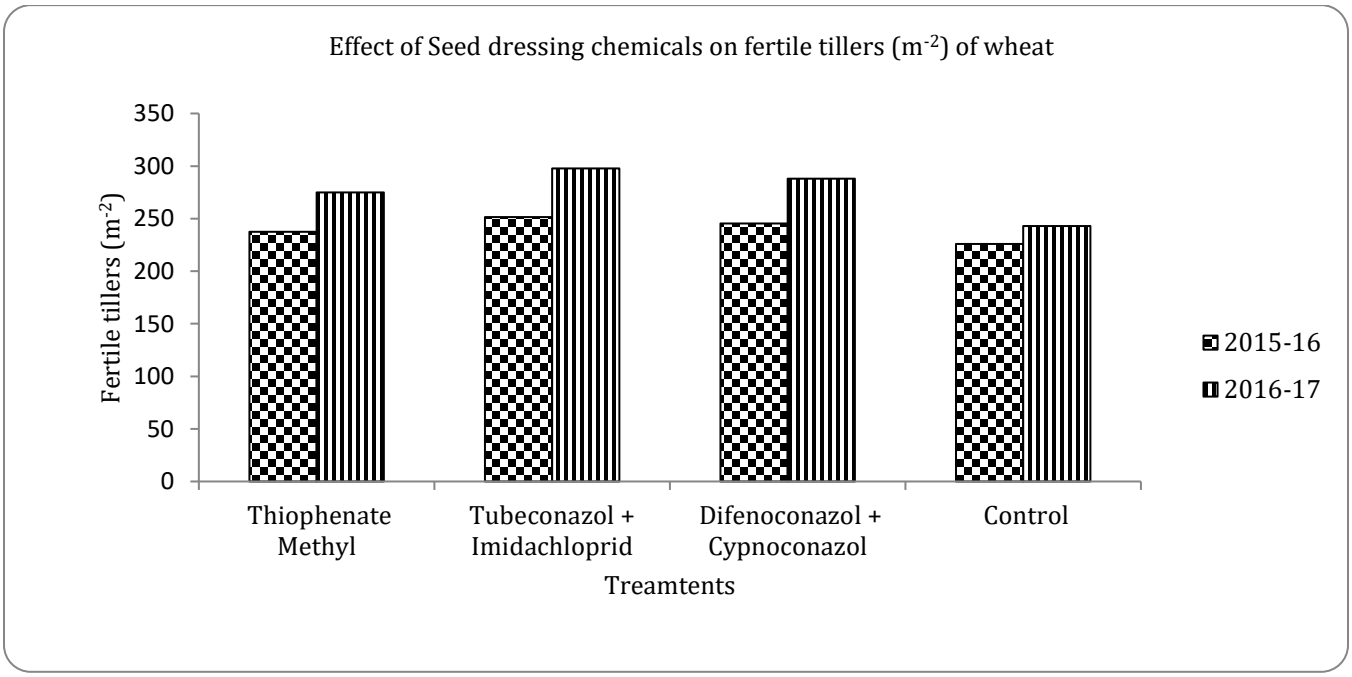
The findings of presented study is supported by Pikushova, (1995) indicated that Raxil (tebuconazole) used as wheat seed treatment controlled *Alternaria* and *Fusarium* and increased seed germination. El-Kholy, (1999) also indicated that fungicidal seed treatment of wheat increased at the rate of 15 -20 percent more number of healthy plants m^{-2} as compared to that of untreated one and tebuconazole was found the most effective fungicide. Sharma-Poudyal *et al*; (2005) described that seed treatment increased the germination and reduced seedling infection. It was reported by Platz *et al*; (2001) that possible effects on emergence have been indicated by the triazole fungicides. The findings of above mentioned authors supported the results presented in this study, it also depicts that in the rice –wheat cropping system wheat seed treatment with compound fungicides enhance the emergence of wheat.

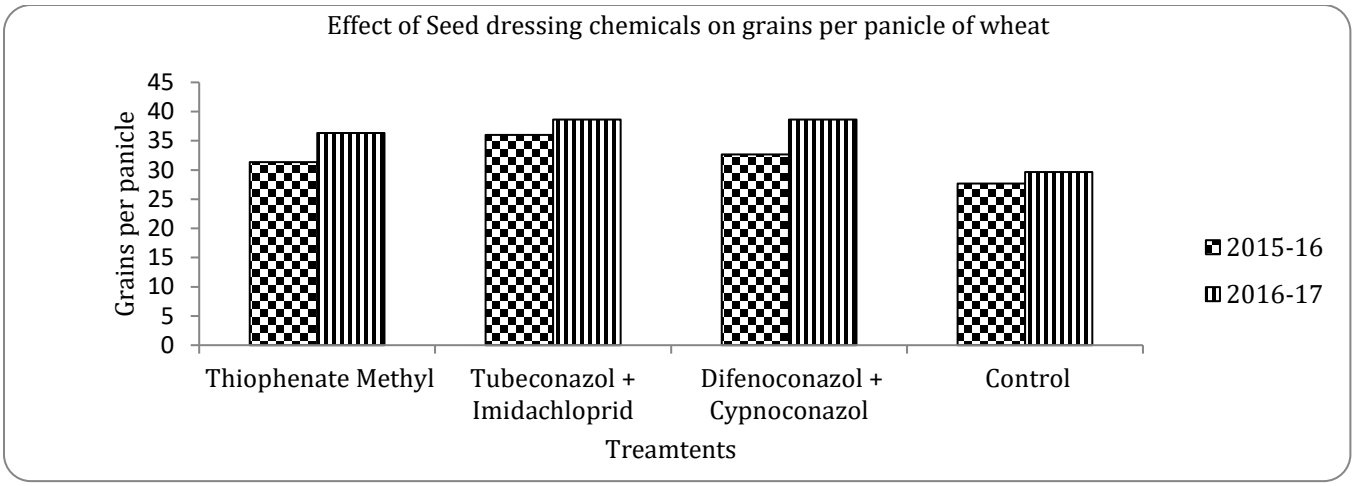
Table.2. Influence of seed dressing fungicides on yield parameters during two growing seasons

Treatments	Plant height (cm)		No. of fertile tillers m^{-2}		Grains/panicle		1000 grain weight (g)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
T_1	94.17bc	102.53 b	237.33 c	275.00 c	31.33 b	36.33 a	42.13 b	38.11 c
T_2	100.80a	106.00 a	251.33 a	297.67 a	36.00a	38.66 a	45.38 a	41.25 a
T_3	96.07 b	104.00 ab	245.33 b	288.00 b	32.66ab	38.66 a	42.53 b	39.81 b
T_4	91.67c	98.10 b	226.00 d	243.00 d	27.66 c	29.66 b	42.20 b	35.75 d
LSD P≤ 0.05	4.39	3.20	LSD 4.46	4.75	3.63	4.19	1.79	1.20

Means having different letters vary significantly at P≤ 0.05





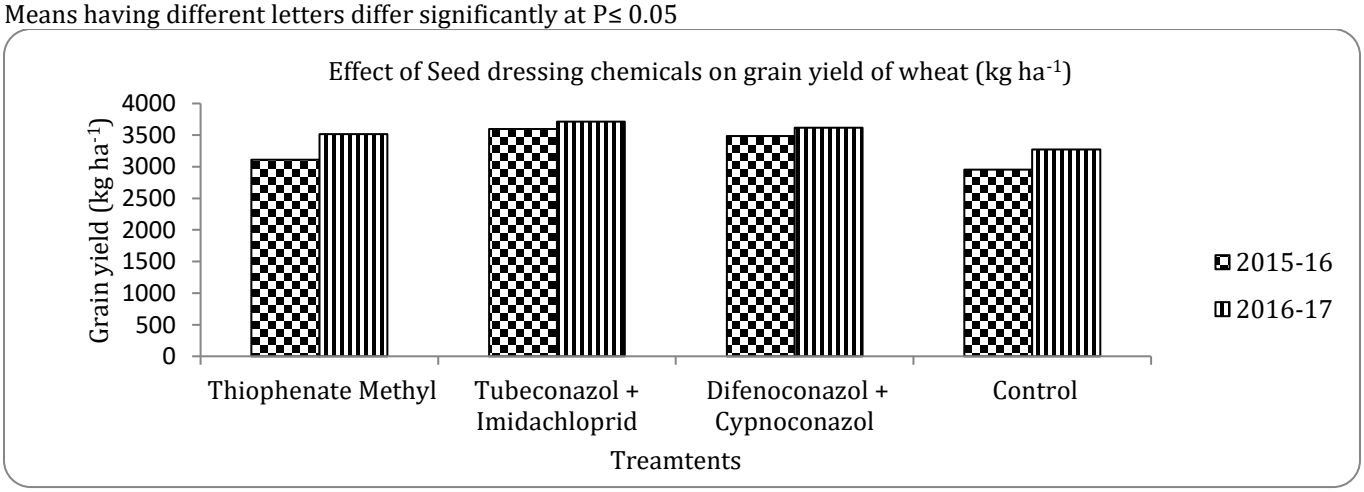


It is presented in (Table.2) that on the average of values obtained from two growing season about 9% increase in plant heights, 17 % more productive tillers per square meter, 31% increasing trend in healthy grains per spike & 10% increase in thousand grains weight were recorded from the plot treated with T_2 (Tubeconazol + Imidachloprid) as compared to untreated plot. Same trend of results offered by Bradley *et al*., (2001) and Cook *et al*., (2002) they reported that for disease management fungicidal treatment is commonly used and found positive impact of treating seeds with triazol fungicides on early plant growth. The findings of this study are also in agreement with those of Khanzada *et al., (*2002) tested the efficacy of different fungicides for the control of seed borne fungi and reported that all fungicides significantly increased the seedling emergence, grains per spike and thousand grains weight over control. Kadege., (2013) also reported that seed treatment with fungicides like metalaxyl plus mancozeb and others resulted in increasing trend of number of grain per spike, 100 grain weight and total grain yield.

Table 3. Effect of seed dressing fungicides on grain yield during two growing season.

Treatments	Grain Yield (kg ha^{-1})			
	2015-16		2016-17	
	Yield	% increase/ decrease	Yield	% increase/ decrease
T_1= Thiophenate Methyl	3110.0 c	5.3	3513.3 b	7.3
T_2 = Tubeconazol + Imidachloprid	3595.0 a	21.72	3713.3 a	13.4
T_3= Difenoconazol + Cypnoconazol	3487.3 b	18.0	3616.7 ab	10.5
T_4= Control	2953.3 d	--	3273.3 c	---
LSD P≤ 0.05	151.18		117.21	

Means having different letters differ significantly at P≤ 0.05



Maximum grain yield 3654 kg per hectare was recorded from the plot treated with compound fungicide (tubeconazol + imidachloprid) on average of two growing seasons which is about 17.5 percent more than that of untreated plot (3113 kg per ha). Increase in grain yield in treated plots was due to increase in emergence percentage, productive tillers and healthy grains per spike. The results obtained , are in agreement with the findings of Malaker and Mian, (2009) who reported that seed treatment with fungicides improved plant population and increased grain yield. The results presented by Meisner *et al.,* (1994) also supported our findings, they found that seed treatment with fungicides 23% increased the plant stand and grain yield by 18% under field condition.

Table 4. Impact of seed dressing fungicides on percent incidence of different diseases during two growing seasons.

Treatments	Disease incidence percentage during 2015-16			Disease incidence percentage during 2016-17		
	Root rot	Loose smut	Black point	Root rot	Loose smut	Black point
T_1= thiophenate methyl	13.3	1	3	20	2	4
T_2 = tubeconazol + imidachloprid	6.7	0	2	6.7	1	2
T_3= difenoconazol +cypnoconazol	0	0	1	0	0	1
T_4= control (untreated)	26.7	3	5	33.3	3	6

Different trend regarding number of plants affected with root rot, loose smut and discloured grains was observed and presented in (Table4). Difenoconazol +cypnoconazol found the most effective compound fungicide as minimum or no incidence of disease was recorded while in the untreated plot 30 % plants with rotted roots , 3 % plants effected with loose smut and about 5.5 % grains showed symptoms of black point disease during two growing season. It is clearly depicted from the results that wheat seeds treated with compound fungicides gave healthy plant stand and better grain yield. These findings are also in agreement with the results presented by several authors in different aspects studied at different locations. Siddiqui and Zaman, (2004) reported that seed-borne fungi can be controlled by the seed treatment with fungicides. Chen *et al.,* (2010) also reported that triazole fungicides as seed treatment protect the seedlings in the beginning of growing season. Similarly El-Kholy, (1999) also indicated that tebuconazole and triticonazole fungicides exhibited high fungicidal effects against the pathogens that cause root rot.

CONCLUSION

In punjab Pakistan mostly farmers used their own seed for next season wheat crop and it does not fulfil the standard of quality seed. This experiment brings out the efficacy of different fungicides as seed dressing in rice – wheat cropping system. The results of the study depict the benefits of fungicidal treatment to minimize the infection caused by seed or soil borne fungi that deteriorate the quality of seed . Tubeconazol + imidachloprid and Difenoconazol +cypnoconazol compound fungicides exhibited best results in increasng emergence percentage, plant stand & vigour and reduce incidence of root rot ,loose smut & black point disease under ecological zone of Sheikhupura Punjab, Pakistan. However, the regular use of certain seed treatment fungicides capable of the eradicating the fungi in seed have also been extremely important.

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