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# EVALUATION OF DIFFERENT FUNGICIDES AGAINST BLAST, BROWN LEAF SPOT AND SHEATH BLIGHT OF RICE UNDER FIELD CONDITIONS IN SHEIKHUPURA, PAKISTAN

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**A B S T R A C T**

Blights, blasts and leaf spot diseases of rice limit the grain yield and deteriorate the produce quality. A field study was carried out for evaluating various fungicides to manage paddy diseases; brown leaf spot, blast & sheath blight under field conditions at research area of Adaptive Research Farm Sheikhupura, Punjab Pakistan during crop season kharif 2018 & 2019. An experiment was conducted in RCB design with three repeats and five treatments including control. Treatments comprised of four different fungicides viz: Azoxystrobin + Difenoconazol, Kasugamysin + Copperoxychloride, Copper Hydroxide & Trifloxystrobin + Tubeconazol @ 500 ml, 625 ml, 625 g & 160 g $ha^{-1}$ respectively and a control (untreated check plot). Among the chemical fungicides Azoxystrobin + Difenoconazol @ 500 ml $ha^{-1}$ was found effective against brown leaf spot and sheath blight with 84.6 % & 81.7 % decrease over control along with 37.4 & 36.7 percent higher yield than check plot followed by Trifloxystrobin + Tubeconazol with 74.8 & 74.3 percent protection values as compared to control during years 2018 & 2019 respectively. In case of paddy blast the fungicide containing Kasugamycin + Copperoxychloride showed better results with 82.5% & 79.4% decrease over control. Maximum incidence level of Brown leaf spot, paddy blast and sheath blight were found in control (non-treated plot) during both years. So, azoxystrobin+ difenoconazol and kasugamycin containing fungicides could be suggested for management of brown leaf spot, sheath blight and paddy blast.

**Keywords**: Fungicides, BLS, Paddy blast, paddy yield.

## INTRODUCTION

Globally rice is grown on 158 mha land and it fulfils the food needs of about half of the world population. Asia alone produces almost 90% of world rice. Rice is called the queen of cereals and it accounts for being staple food of 50% world population. In Pakistan, rice holds 3rd position for cultivated area after wheat and cotton. In Pakistan, during 2019 total area under paddy crop was 3034 thousand hectares with 7410 thousand tons production. (Anonymous, 2019). Fine rice varieties of Pakistan, specifically basmati varieties possessing a specific aroma are highly liked in the world. But

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unfortunately, these world-famous basmati varieties of rice are susceptible to many diseases. Major diseases limiting the rice production in Pakistan include blast, sheath blight, BLB and brown spot. *Pyricularia oryzae* induce rice blast shows its symptoms on all aerial parts of the plant including formation of eye-shaped lesions on leaves having whitish to gray centers and red to brownish peripheral circles. Discoloration of panicle neck is also observed causing the breakage and fall of the panicle. Rice blast being an infectious disease causes significant reduction in the crop yield as well also deteriorates the produce quality (Pasha *et al*., 2013). Brown leaf spot of rice is caused by *Helminthosporium oryzae*. It is accompanied with the appearance of oval shaped uniform spots on the surface of leaves. These spots are equal to sesame seed in size and shape and are evenly distributed over the surface of leaf. They turn to brown color at maturity stage with grey or whitish central portion and peripheral area of reddish-brown color. In case of sheath blight, irregularly shaped lesions are developed on the leaves of plant. These lesions have brown margins with gray-white center. This disease is caused by *Rhizoctonia solani* and the leaves infected by this disease dry out quickly. and leading towards reduced leaf area of the crop canopy. The newly emerged tillers are also affected by this disease. Both the reduced leaf area and infected tillers cause drastic reduction in the final crop yield.

Rice diseases management through fungicides is one of the most widely used control tactics. When symptoms of sheath blight spread to upper parts of plants and panicles then crop may be totally lost and this disease has global prevalence (Savary *et al*., 2006). It was also indicated that Brown leaf spot, sheath blight and grain discoloration can flare up under conducive climatic conditions and chemical control offers great potential in reducing the diseases (Singh *et al*., 2007).

Under field conditions, different management options like the use of disease resistant varieties, better cultural practices and biological control are also used for disease management. However, sole reliance on the cultural practices is not sufficient and they also need quick optimization under everly changing ecological paradigm every year. So, chemical control option is the most acceptable and economic one as it promises the most efficient disease management (Bhuvenishwari and Raju, 2012).

As for as the chemical control is concerned, their judicious use is not only economical but also ensures efficient and quick control of diseases and higher crop yield with relatively better quality of produce. Fungicides are most often being used for controlling different rice diseases but they possess spatial efficacy. Kumar *et al*., (2013) reported that systemic products and compound fungicides has been introduced for effective management of rice diseases. Singh and Sinha (2004) reported that newly introduced fungicides found effective against sheath blight and other rice diseases. Availability of a wide array of fungicides in market makes the farmers confused in selecting the most appropriate one for a specific disease. It is the dire need of time to advise the rice growers/ farming community a revolving scheme of fungicides to prevent the infectious fungi from developing resistance against these fungicides.

Dissemination of technology to the local farmers is the main objective of research conducted in local agro-ecological zones. So, information about effective fungicides should be presented to farmers. In this context present experiment was conducted under field conditions to evaluate different fungicides for controlling these rice diseases so that suitable and site-specific recommendations should be communicated to farmers.

**MATERIALS AND METHODS**

Randomized Complete Block Design was employed to establish the experiment comprising five treatments in tri-replicated fashion with 7.2 m × 3 m plot size under field conditions at Adaptive Research Farm Sheikhupura, Punjab, Pakistan during Kharif seasons 2018 & 2019. Rice nursery (30-day old) of super basmati cultivar was transplanted in puddled field. A square planting geometry with dimensions of 22.5 cm × 22.5 cm was maintained for achieving uniform plant population in all experimental units. NPK fertilizers was applied according to departmental recommendations. All phosphorus & half potash was supplied to crop before transplanting and nitrogen was applied in two splits at 25 & 50 days after transplanting. Half potash was applied with 2$^{nd}$ split of nitrogen. Fungicides were sprayed upon the appearance of disease. No artificial inoculation was made and data were recorded based on natural incidence of the disease. For disease scoring, ten sample plants per each plot were selected at random. Disease scoring was done by visual estimation with reference to IRRI scale before and after application of fungicides. Data pertaining to diseases severity, yield attributes as well as final grain yield was collected. For disease scoring the data on disease severity was categorized in 0-9 scale using a IRRI's typical assessment system for rice (SES, 2002).

0= Absence of any lesions
1= Pin point sized small brown speaks
2= Lower leaves having slightly elongated round disc shaped and grey colored necrotic spots (1-2 mm in diameter)
3= Upper leaves with significant number of lesions described in 2
4= Leaves having 2% infectious lesion on leaf area basis
5= Leaves having 2-10% typical infectious lesions on leaf area basis
6= Leaves having 11-25 % typical infectious lesions on leaf area basis
7= Leaves having 26-50 % typical infectious lesions on leaf area basis
8= Leaves having 51-75 % typical infectious lesions on leaf area basis
9= Leaves having more than 75 % typical infectious lesions on leaf area basis

$$\text{Disease index (\%)} = \frac{\text{Sum of initial rating}}{\text{Number of leaf observed}} \text{ X } 100$$

$$\text{Disease Control (\%)} = \frac{C - T}{C} X\ 100$$

Where "C" stand for control (check plot) and "T" for treated experimental units.

**Treatments**

$T_1$= Difenoconazol + Azoxystrobin @ 500 ml $ha^{-1}$
$T_2$= Kasugamysin + Copperoxychloride @ 625 ml $ha^{-1}$
$T_3$= Copper Hydroxide @ 625 g $ha^{-1}$
$T_4$= Trifloxystrobin + Tubeconazol @ 160 g $ha^{-1}$
$T_5$= Control (check plot)

The statistical analysis for the collected data was performed using statistical software package Statistix 9.0. The significant means for each characteristic were adjudged using least significant difference (LSD) at p≤5% (Steel *et al*., 1997).

**RESULTS AND DISCUSSIONS**

All the fungicides were found effective in reducing rice diseases with different level of significance as compared to control. The results presented in table 1 & 3 indicated that minimum 6.14 and 8.90 brown leaf spot, 6.80 and 5.93 sheath blight percent incidence with 84.6 and 81.7 and 78.4 and 83.4 percent decrease over control were recorded with the use of Azoxystrobin + Difenoconazol @ 500 ml $ha^{-1}$ during both crop seasons. It was followed by Trifloxystrobin + tubeconazol treated plot where 74.8 and 74.3 and 63.9 and 71.3 percent decrease over control of brown leaf spot and sheath blight respectively was recorded during both year while in case of paddy blast Kasugamycin + Copperoxychloride showed good results with minimum 5.96 and 8.66 disease severity and 82.5 and 79.4 percent decrease over control was recorded during kharif 2018 and Kharif-2019, respectively (Table- 2). The mean value for both years of study showed that maximum disease severity 44.4, 38.0 and 33.6 percent for brown leaf spot, paddy blast and sheath blight, respectively was observed in the check plot. Our results are consistent with Ghazenfer *et al*., (2009) and Lore *et al*., (2007) who stated that chemical control is effective and important in management of rice diseases.

Highest grain yield 4374.7 and 4467.8 kg $ha^{-1}$ was obtained in case of Azoxystrobin + Difenoconazol application and it was followed by Trifloxystrobin + Tubeconazol treated plot where 4019.7 and 4376.7 kg $ha^{-1}$ paddy yield was recorded during kharif seasons 2018 and 2019, respectively. Minimum paddy yield 3184.3 and 3266.7 kg $ha^{-1}$ was obtained from Control treatments. (Table-5)

Data regarding yield parameters including productive tillers, grains per spike and thousand grains weight (table-4) depicts that increasing trend of yield parameters was recorded with the application of Azoxystrobin + Difenoconazol during both crop seasons. It is also in accordance with the finding of Parasanna and Veerabhadraswamy, (2014) who reported that fungicides application increases the final grain yield of paddy. Ganesh *et al.,* (2012) and Debashis *et al*., (2012) also showed that compound fungicides are effective against brown leaf spot and paddy blast with increase in paddy production by managing rice diseases. The results of underlying study verify the report documented by Mishra *et al*., (2007) stating that chemical control of rice diseases improve paddy yield as compared to control. Kumbhar, (2005) also reported that chemicals used against control of paddy blast has given good response for controlling the disease. Our findings are also in agreement with different workers regarding chemical control of brown leaf spot and paddy blast. Singh *et al*., (2007) reported that rice diseases can be managed by application of chemical fungicides coupled with increase in paddy yield. Savary *et al*., (2006) also reported that rice blast, BLS and sheath blight are economically important fungal diseases of rice and chemical fungicides are quite beneficial, if applied at proper time.

Table 1. Management of Brown leaf spot disease of rice using different fungicide during Kharif- 2018 and 2019

| Treatments | Percentage incidence of Brown Leaf Spot and Percent Decrease over Control of Different Fungicides | | | | | |
|---|---|---|---|---|---|---|
| | Kharif- 2018 | | | Kharif- 2019 | | |
| | Pre-treatment | Post-treatment | Decrease over Control (%) | Pre-Treatment | Post-Treatment | Decrease over Control (%) |
| $T_1$= Difenoconazol + Azoxystrobin | *4.84 | 6.14 d | 84.6 | 7.13 | 8.90 d | 81.7 |
| $T_2$= Kasugamysin + Copperoxychloride | 5.32 | 11.0 c | 72.5 | 8.36 | 16.50 c | 66.0 |
| $T_3$ = Copper Hydroxide | 5.88 | 18.70 b | 53.4 | 9.16 | 21.40 b | 55.9 |
| $T_4$ = Trifloxystrobin + Tubeconazol | 6.40 | 10.10 c | 74.8 | 7.80 | 12.50 cd | 74.3 |
| $T_5$ = Control | 4.73 | 40.10 a | - | 8.45 | 48.63 a | - |
| LSD (p≤5%) | NS | 3.94 | | NS | 4.30 | |

Means with different letters within the same column differ from each other at probability (p≤5%)

Table 2. Effect of Different Fungicides for the management of Paddy Blast during the Kharif- 2018 and 2019

| Treatments | Percentage incidence of paddy leaf blast and Percent Decrease over Control of Different Fungicides | | | | | |
|---|---|---|---|---|---|---|
| | Kharif- 2018 | | | Kharif- 2019 | | |
| | Pre-treatment | Post-treatment | Decrease over Control(%) | Pre-Treatment | Post-Treatment | Decrease over Control (%) |
| $T_1$= Difenoconazol + Azoxystrobin | *2.79 b | 7.86 c | 76.9 | 2.79 c | 14.4 bc | 65.7 |
| $T_2$= Kasugamysin + Copperoxychloride | 5.0 a | 5.96 c | 82.5 | 5.00 bc | 8.66 d | 79.4 |
| $T_3$ = Copper Hydroxide | 3.82 ab | 12.98 b | 61.9 | 7.59 a | 18.80 b | 55.2 |
| $T_4$ = Trifloxystrobin + Tubeconazol | 5.18 a | 12.90 b | 62.2 | 6.95 ab | 12.56 cd | 70.0 |
| $T_5$ = Control | 5.02 a | 34.10 a | - | 6.26 ab | 42.0 a | - |
| LSD 5% | 1.91 | 4.35 | | 2.33 | 4.52 | |

Means with different letters within the same column differ from each other at probability (p≤5%)

Table 3. Effect of Different Fungicides for the management of Sheath blight of rice during Kharif- 2018 and 2019

| Treatments | Percentage incidence of Sheath Blight and Percent Decrease over Control of Different Fungicides | | | | | |
|---|---|---|---|---|---|---|
| | Kharif- 2018 | | | Kharif- 2019 | | |
| | Pre-treatment | Post-treatment | Decrease over Control (%) | Pre-Treatment | Post-Treatment | Decrease over Control (%) |
| $T_1$= Difenoconazol + Azoxystrobin | 3.49 | 6.80 c | 78.4 | 2.76 b | 5.93 d | 83.4 |
| $T_2$= Kasugamysin + Copperoxychloride | 4.94 | 16.83 b | 46.5 | 3.60 ab | 13.60 c | 61.9 |
| $T_3$ = Copper Hydroxide | 4.65 | 18.03 b | 42.5 | 4.83 a | 18.63 b | 47.9 |
| $T_4$ = Trifloxystrobin + Tubeconazol | 3.59 | 11.33 c | 63.9 | 3.70 ab | 10.26 cd | 71.3 |
| $T_5$ = Control | 4.39 | 31.46 a | - | 3.93 ab | 35.76 a | - |
| LSD (p≤5%) | NS | 4.62 | | 1.48 | 4.89 | |

Means with different letters within the same column differ from each other at probability (p≤5%)

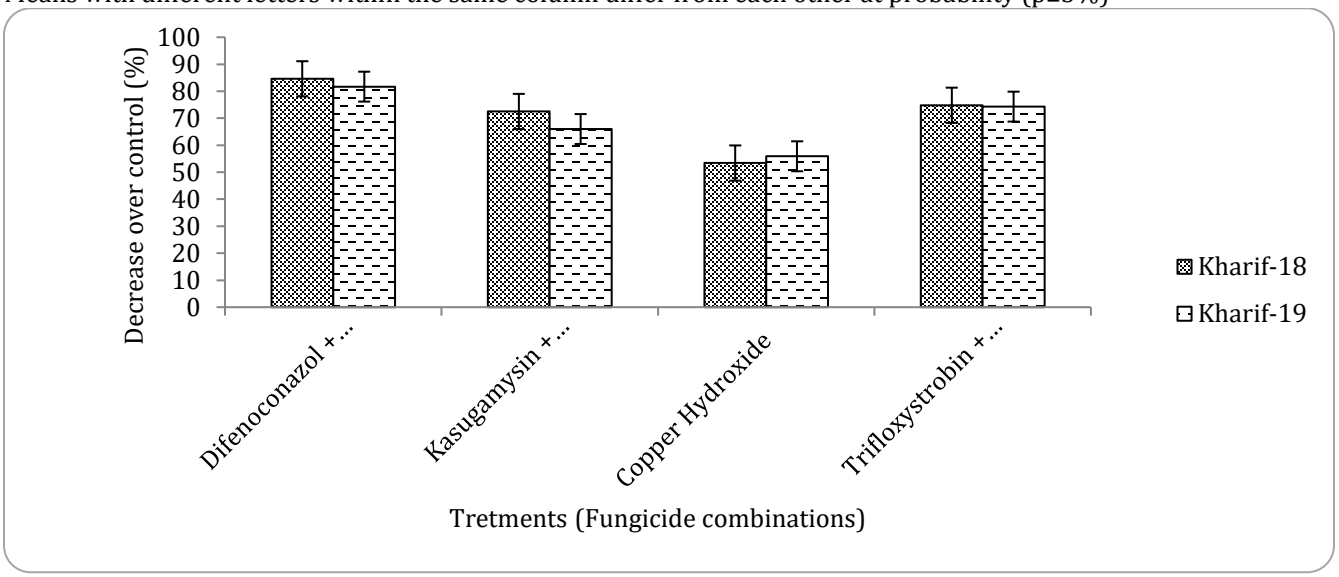


Figure 1. Decrease (%) in brown leaf spot of rice by the application of different fungicide combinations during Kharif-2018 and 2019

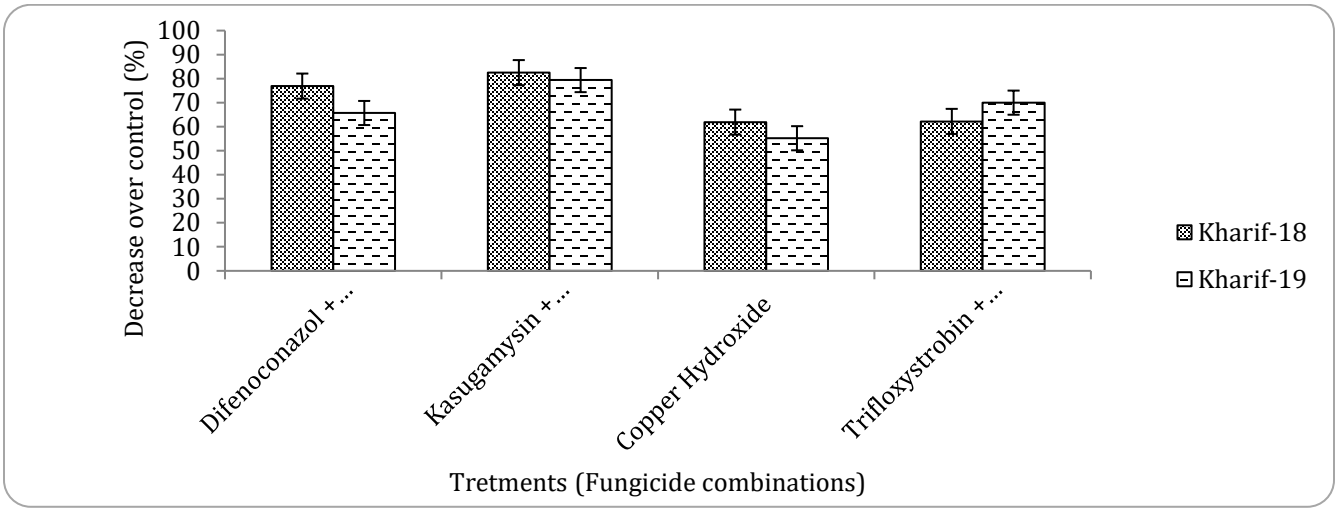


Figure 2. Decrease (%) in paddy blast of rice by the application of different fungicide combinations during Kharif-2018 and 2019

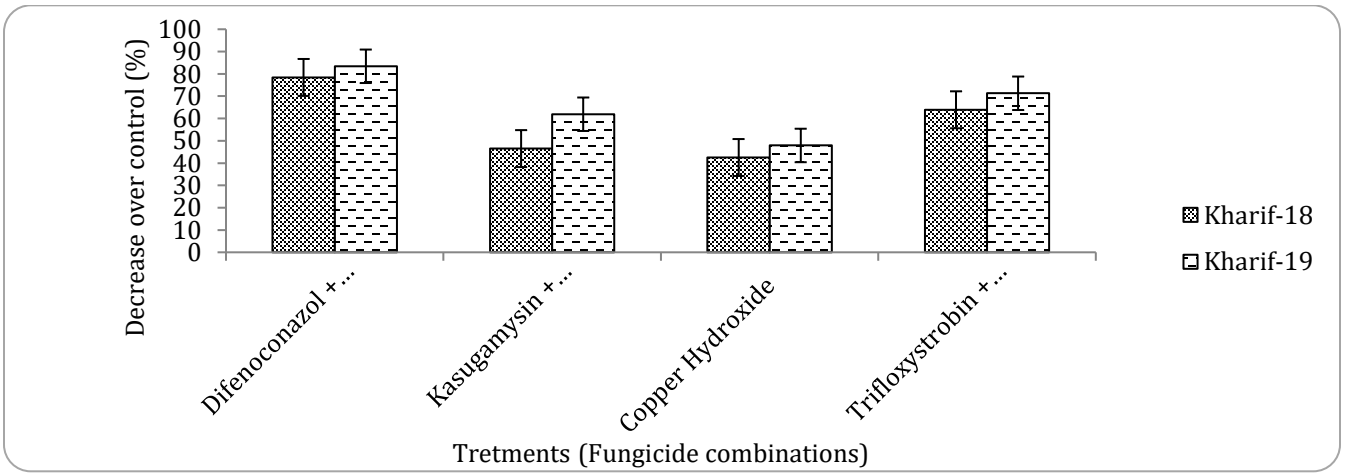

Figure 3. Decrease (%) sheath blight of rice by the application of different fungicide combinations during Kharif-2018 and 2019

Table 4. Effect of fungicides on yield and yield components in rice during Kharif- 2018 and 2019

| Treatments | Plant height (cm) | | Number of fertile tillers ($m^{-2}$) | | Grains per panicle | | 1000 grain weight (g) | |
|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 |
| $T_1$= Difenoconazol + Azoxystrobin | 113.7 a | 113.0 a | 246.6 a | 344.6 a | 96.0 a | 119.6 a | 19.1 | 20.1 ab |
| $T_2$= Kasugamysin + Copperoxychloride | 111.3 ab | 112.7 a | 243.3 a | 330.6 b | 91.7 b | 98.3 b | 19.3 | 19.2 b |
| $T_3$ = Copper Hydroxide | 109.9 ab | 107.3 b | 241.6 ab | 305.0 c | 82.0 c | 90.6 b | 18.3 | 18.0 c |
| $T_4$ = Trifloxystrobin + Tubeconazol | 111.3 ab | 110.3 ab | 242.3 ab | 341.6 ab | 88.3 b | 112.0 a | 19.2 | 20.2 a |
| $T_5$ = control | 108.0 b | 107.7 b | 237.0 b | 312.3 c | 74.7 d | 90.0 b | 18.2 | 17.3 c |
| LSD (p≤5%) | 5.09 | 4.68 | 6.24 | 13.05 | 3.38 | 8.45 | NS | 1.03 |

Means with different letters within the same column differ from each other at probability (p≤5%)

Table 5. Effect of different fungicides on paddy yield during Kharif- 2018 and 2019

| Treatments | Paddy Yield (kg $ha^{-1}$) | | | |
|---|---|---|---|---|
| | 2018 | | 2019 | |
| | Yield | Increase/decrease (%) | Yield | Increase/decrease (%) |
| $T_1$= Difenoconazol + Azoxystrobin | 4374.7 a | 37.4 | 4467.8 a | 36.7 |
| $T_2$= Kasugamysin + Copperoxychloride | 4285.3 b | 34.6 | 4160.0 b | 27.3 |
| $T_3$ = Copper Hydroxide | 3751.3 d | 17.8 | 3583.3 c | 9.6 |
| $T_4$ = Trifloxystrobin + Tubeconazol | 4019.7 c | 26.2 | 4376.7 a | 33.9 |
| $T_5$ = control | 3184.3 e | - | 3266.7 d | - |
| LSD (p≤5%) | 56.73 | | 157.86 | |

Means with different letters within the same column differ from each other at probability (p≤5%)

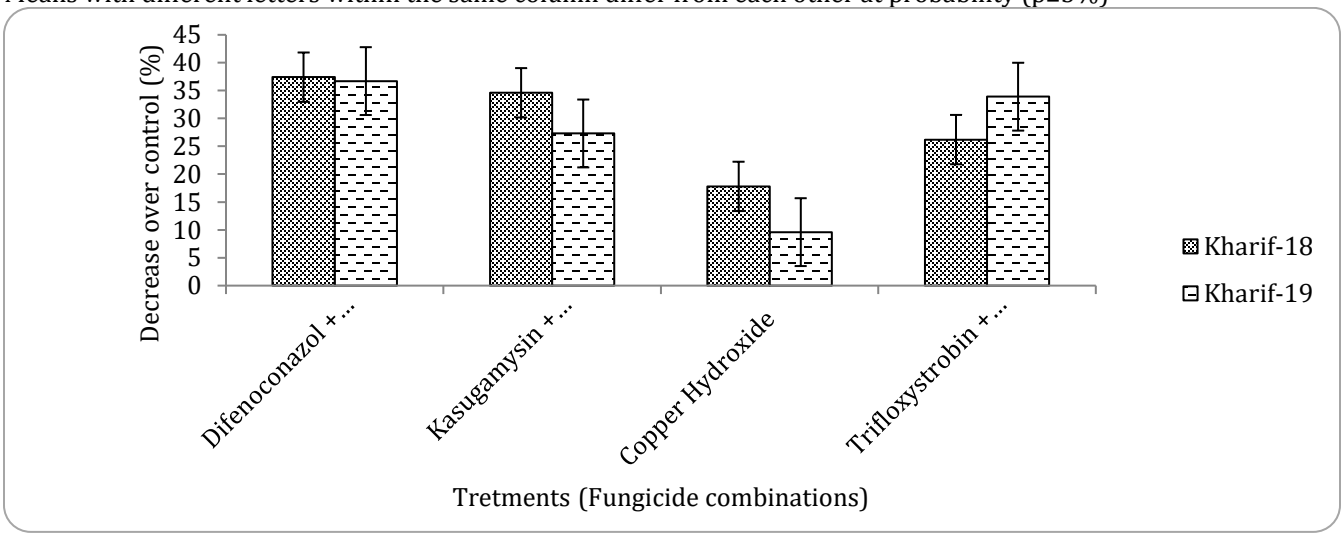


Figure 4. A comparative percentage increased based assessment for paddy yield by application of different fungicide combinations to rice during Kharif-2018 and 2019

**CONCLUSION**

Among the studied fungicidal compounds, Azoxystrobin + Difenoconazol proved best in controlling the brown leaf spot and sheath blight with higher paddy yield while in case of paddy blast Kasugamycin + Copperoxychloride was found to be most effective followed by Azoxystrobin + Difenoconazol. So, it is suggested to the rice growers must use Azoxystrobin + difenoconazol containing fungicides in controlling sheath blight and brown leaf spot. Moreover, paddy blast could be optimally managed

by using Kasugamycin + copper oxychloride at proper time.

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