# EFFECT OF ORGANIC SOIL AMENDMENT ON FOLIAR FUNGAL DISEASES OF RAPESEED – MUSTARD UNDER ORGANIC FARMING SYSTEM IN MANIPUR

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Abstract: The organic manures used resulted significant effects on white rust, *Alternaria* blight and downy mildew of rapeseed – mustard. Treatment ($T_5$) which allows all the combinations of manures provided best results while $T_2$ treatment the least. In the present study, highest disease control was found in $V_3$ (51.69 %) for white rust, in $V_4$ (59.41 %) for*Alternaria* blight and in $V_3$(50.43%) for downy mildew. Overall disease control was detected in $V_3$ (59.41%) in *Alternaria* blight. The easily available local organic manures could play a good role in sustainable agriculture. They helped in eco-friendly disease management of the crop.

Keywords: Rapeseed – mustard, soil amendment, organic manure, eco – friendly, Compost.

**INTRODUCTION:**

Rapeseed – mustard is one of the most important cruciferous crops basically cultivated for oils and vegetables during *rabi*season (October–March) in Manipur for domestic consumption. It plays an important role in edible oilseed sector of India. The agro-climatic conditions of the state is very much congenial for the cultivation of the crop. However, the crop was infested by many diseases prominently fungal diseases which cause limitation in the production of the crop. More than 30 diseases including fungal diseases were known to occur on Brassica crops in India (Saharan, 1992).Management of diseases using synthetic chemicals resulted harmful effects on environment, soil and human health by virtue of hazardous residues of chemicals.The continuous and comprehensive use of chemical fertilizers impart various undesirable effects on the agricultural ecosystem like degradation of soil, loss of crop genetics and microbial diversity, contamination of groundwater , and pollution of the atmosphere (Chaudhry*et al*,. 2009). Besides changes in production system with chemicals have been detrimental to soil health and water quality, leading to an increase in plant diseases and other pest problems, all within a relatively short period of time (Hoitink and Boehm, 1999).

Soil is the fundamental for agriculture irrespective of other inputs. Soil is a dynamic, living , natural body which is vital for the correct functioning of terrestrial ecosystems and it represents a unique balance between physical, chemical and biological (Shukla and Verma, 2011). Application of manure and composts on agricultural lands has been shown to positively increase and enrich soil food web ( bacteria, fungi, protozoa and nematode density) and also affect a number of soil characteristics, including SOM (soil organic matter) and soil respiration ( Carrera *et al*., 2007;Treonis *et al*., 2010). An estimate by World Health Organization (WHO) put the annual number of acute poisoning by pesticides at 3 million with 0.22 million deaths (Hoddy, 1993). Hence, IPM strategies towards organic approach need to be advanced across the world. Food and environmental safety are often cited reasons for the use of alternative soil amendments, but increasingly economic considerations are becoming foods (Govindasamy and Italia, 1998). All such positive impacts, organic farming is becoming a tool for sustainable agriculture and IPM strategies. As such with the view of developing eco-friendly management strategy, the present work was conducted to study the effect of organic amendments of soil on fungal diseases of rapeseed – mustard in Manipur.

**MATERIALS AND METHODS:**

Field experiments were conducted at Kakching located in 24° 29′ 30″ N latitude and 93°59′ 30″ E longitude and about 45km away from Imphal, Manipur for two consecutive *rabi* seasons (2014-15 & 2015-16) to evaluate the effect of different organic manures. The crop is raised in sandy clay loam soil having P $^{H}$ 5.99. The experimental field has an earlier record of growing seasonal vegetables including mustard. The experimental varieties are two rapeseed varieties [*Brassica. rapa* (L.) var. M27 ($V_3$) and*B. rapa*(L.) var. *ragini*($V_4$ )] and two local cultivars of mustard [*B. juncea* (L.) Czern.&Coss. cv. Local Yella ($V_1$) and *B. juncea* Czern. &Coss. cv. Lamtachabi ($V_2$)] ). Seeds were sown in the last week of October inplots [(2.2 x 1.3) $m^2$] keeping 5 cm border line. Seeds

were sown using a kind of broadcasting in which 5-6 seeds were sown in each sub –plot and finally only one plant was kept by thinning after two weeks. The crop was laid out in a randomized block design (RBD) and three replications were maintained. Other cultural practices such as weeding, irrigation were done as practiced by local farmers during the growing period in both the seasons.

Effects of organic amendments were tested using five different organic manures. Organic manures were amended @ 18 tonnes /hectare (5kg / plot) at the time of field preparation seven days prior to seed sowing. The organic manures were obtained from nearby areas of Kakching however, compost was prepared in advance to use in the growing season by following the method (Howard, 1943). The experimental plots were amended either singly or in combination with different soil amendments in the following combinations:

$T_1$ = Poultry manure + FYM

1 : 4
1 kg + 4 kg

$T_2$= Piggery waste + FYM

1 : 4
1kg + 4 kg

$T_3$ = Cowdung + Rice husk

2 : 1
3.34 kg + 1.67 kg

$T_4$ = Compost + FYM

1 : 1
2.5 kg + 2.5 kg

$T_5$ = Poultry manure + Piggery waste +Cowdung+ Rice husk + Compost + FYM (0.83 kg each)
$T_0$ = Control

**COMPOST PREPARATION:**

Preparation of compost was done by following the method as described by Howard (1943). The ingredients used in composting were vegetable mixtures (including grasses) , kitchen wastes, hard resistant materials viz., sawdust (soaked) , sugarcane leaves about to fall (soaked), Farmyard manure(FYM) , wood ash which were collected from nearby areas of Kakching and water . The grasses were being cut into pieces in the size of 10 – 15cm. The size of the compost field was 3 x 1.5 x 1 (length x breath x height) $m^3$. Composting was done prior to growing season of the crop so as to use it in the same season. Maturation of compost took place in three months and yielded 65 kg (approx.) of compost.

**SAMPLING AND SCORING OF DISEASE PARAMETERS :**

A weekly survey was carried out starting from 45 DAS (days after sowing) after the appearance of disease. The survey schedules continued up to six weeks for quantification of diseases associated with the crop. The disease assessment techniques were disease incidence, disease severity and AUDPC (area under disease progress curve). Data on disease severity (DS) of rapeseed- mustard were recorded from 25 leaves randomly selected from 5 plants in each plot after appearance of disease and tagged. Diseases were rated using 0-6 scale for white rust (Barbetti*et al*., 2011), 0-5 scale for *Alternaria* blight (Awasthi and Kolte, 1994) and 0-5 scale for downy mildew(Singh and Singh, 2003). The disease parameters for various fungal diseases were worked out as follows:

i. Disease incidence (DI%) = $\frac{\text{Number of plants infected by a particular disease}}{\text{Total number of plants observed}}$ x 100

ii. Disease severity ( DS%) = $\frac{\text{Sum of all numerical ratings}}{\text{Nunber of leaves observed x Maximum number of rating scale}}$ x 100

iii. AUDPC $= \sum_{i-1}^{n}[\,(y_{i+1} + y_i)/2\,]\,[\,x_{i+1} - x_i\,]$ (Shaner and Finney, 1977)

where,

$y_i$ and $y_{i+1}$ = Disease severity in the $i^{th}$ and $(i + 1)^{th}$ observations

$x_i$ and $x_{i+1}$= Time (weekly) in the $i^{th}$ and $(i + 1)^{th}$ observations

andn = Total number of observations

Table 1: *In vivo* effect of various soil amendments against disease parameters of **White rust** on rapeseed –mustard under organic farming at Kakching ( Pooled data for two *rabi* seasons : 2014-15 & 2015 -16)

| Treatments | Disease Incidence (%) | | | | Disease Severity (%) | | | | AUDPC | | | | Disease control ( %) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ |
| $T_1$ | 32.86 | 29.34 | 20.74 | 23.01 | 19.15 | 18.96 | 12.14 | 13.70 | 191.50 | 189.60 | 121.40 | 137.00 | 26.94 | 31.33 | 39.66 | 46.46 |
| $T_2$ | 43.46 | 44.05 | 26.44 | 25.54 | 22.72 | 23.72 | 15.94 | 16.39 | 231.60 | 237.20 | 159.40 | 163.90 | 13.31 | 14.09 | 20.77 | 23.98 |
| $T_3$ | 38.23 | 40.39 | 24.35 | 20.31 | 19.58 | 21.57 | 13.73 | 13.82 | 195.80 | 215.70 | 137.30 | 138.20 | 25.29 | 21.88 | 31.76 | 35.90 |
| $T_4$ | 28.25 | 34.18 | 16.79 | 17.43 | 16.83 | 18.03 | 11.52 | 11.79 | 168.30 | 180.30 | 115.20 | 117.90 | 35.79 | 34.70 | 42.74 | 45.31 |
| $T_5$ | 35.11 | 27.87 | 18.55 | 16.13 | 16.67 | 16.85 | 9.72 | 10.95 | 166.70 | 168.50 | 97.20 | 109.50 | 36.40 | 38.97 | 51.69 | 49.21 |
| $T_0$ | 49.27 | 48.98 | 30.18 | 32.69 | 26.21 | 27.61 | 20.12 | 21.56 | 262.10 | 277.40 | 201.20 | 215.60 | | | | |
| C.D. at 5% | | | | | *0.56 | *0.67 | *0.49 | *0.14 | | | | | | | | |

*Significant at 5 % level of significance; AUDPC = Area Under Disease Progress Curve.

Table 2 :*In vivo* effect of various soil amendments against disease parameters of ***Alternaria* blight** on rapeseed –mustard under organic farming at Kakching ( Pooled data for two *rabi* seasons : 2014-15 & 2015 -16)

| Treatments | Disease Incidence (%) | | | | Disease Severity (%) | | | | AUDPC | | | | Disease control ( %) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ |
| $T_1$ | 35.93 | 36.57 | 22.97 | 25.31 | 17.25 | 17.88 | 9.64 | 10.73 | 172.50 | 178.80 | 96.40 | 107.30 | 26.00 | 26.60 | 41.22 | 46.56 |
| $T_2$ | 38.51 | 40.11 | 28.18 | 30.04 | 20.47 | 22.36 | 13.30 | 17.74 | 204.70 | 223.60 | 133.00 | 177.40 | 12.18 | 8.21 | 18.90 | 11.65 |
| $T_3$ | 36.44 | 37.20 | 26.30 | 26.32 | 17.28 | 18.37 | 11.62 | 13.61 | 172.80 | 183.70 | 116.20 | 136.10 | 25.87 | 24.59 | 29.15 | 32.22 |
| $T_4$ | 33.05 | 36.85 | 25.04 | 20.54 | 15.67 | 16.54 | 9.41 | 10.04 | 156.70 | 165.20 | 94.10 | 100.40 | 32.77 | 32.10 | 42.62 | 50.00 |
| $T_5$ | 29.53 | 28.55 | 19.02 | 17.39 | 13.82 | 15.32 | 8.71 | 8.15 | 138.20 | 153.20 | 87.10 | 81.50 | 40.71 | 37.11 | 46.89 | 59.41 |
| $T_0$ | 43.26 | 43.31 | 30.39 | 32.43 | 23.31 | 24.36 | 16.40 | 20.08 | 233.10 | 243.60 | 164.00 | 200.80 | | | | |
| C.D.at 5% | | | | | *0.74 | *0.09 | *1.21 | *0.40 | | | | | | | | |

*Significant at 5% level of significance.

Table 3:*In vivo* effect of various soil amendments against disease parameters of **Downy mildew** on rapeseed –mustard under organic farming at Kakching( Pooled data for two *rabi* seasons : 2014-15 & 2015 -16)

| Treatments | Disease Incidence (%) | | | | Disease Severity (%) | | | | AUDPC | | | | Disease control ( %) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_1$ | $V_2$ | $V_3$ | $V_4$ |
| $T_1$ | 21.07 | 23.08 | 17.61 | 17.42 | 13.53 | 16.32 | 9.81 | 11.18 | 135.30 | 163.20 | 98.10 | 111.80 | 40.76 | 34.25 | 39.96 | 36.08 |
| $T_2$ | 26.33 | 28.62 | 21.76 | 22.89 | 19.76 | 19.90 | 13.66 | 13.94 | 197.60 | 199.00 | 136.60 | 139.40 | 13.48 | 19.82 | 16.40 | 20.30 |
| $T_3$ | 23.81 | 25.65 | 18.89 | 20.39 | 15.73 | 17.18 | 11.67 | 12.56 | 157.30 | 171.80 | 116.70 | 125.60 | 31.13 | 30.78 | 28.58 | 28.19 |
| $T_4$ | 20.91 | 21.51 | 18.00 | 17.05 | 12.80 | 16.08 | 9.62 | 9.68 | 128.00 | 160.80 | 96.20 | 96.80 | 43.96 | 35.21 | 41.13 | 44.65 |
| $T_5$ | 20.98 | 19.30 | 16.10 | 15.99 | 11.94 | 14.26 | 8.10 | 9.45 | 119.40 | 142.60 | 81.00 | 95.40 | 47.72 | 42.55 | 50.43 | 45.97 |
| $T_0$ | 29.65 | 32.65 | 24.06 | 25.66 | 22.84 | 24.82 | 16.34 | 17.49 | 228.80 | 248.20 | 163.40 | 174.90 | | | | |
| C.D. at 5% | | | | | *0.56 | *0.40 | *0.37 | *0.56 | | | | | | | | |

*Significant at 5% level of significance.

**DATA ANALYSIS :**

Disease severity (%) was analyzed using ANOVA (one way) to understand any significant differences among the various organic amendments applied. The percent inhibition of organic manures over control was calculated by using the formula (Vincent, 1947). MS- Excel was used for calculation of the data.

**RESULTS AND DISCUSSION:**

The different organic manures provided significant effects on white rust, *Alternaria* blight and downy mildew of the crop (Table 1, 2 &3). Treatment ($T_5$) which allows all the combinations of manures provided best results while $T_2$ treatment the least. It may be due to the variability in the nutrient content of the organic fertilizers. Various authors (Kucey *et al*., 1989; Ponmurugan and Gopi, 2006) reported that microorganisms with phosphate solubilizing potential increased the availability of soluble phosphate and enhanced the plant growth by improving biological nitrogen fixation. As such biological fertilizers can be recommended for the sake of achieving the higher quality production (Isfahani and Besharati, 2012) . The use of organic amendments such as animal manure, green manure, compost and peats has decreased the incidence of disease caused by soil – borne pathogens (Litterick *et al*., 2004; Noble and Coventry,2005). In the present study, highest disease control was found in $V_3$ (51.69 %) for white rust, in $V_4$ (59.41 %) for *Alternaria* blight and in $V_3$(50.43%) for downy mildew.

**CONCLUSION:**

Application of organic amendments provides significant effects on fungal diseases of rapeseed- mustard. The overall disease control was detected in $V_3$ (59.41%) in *Alternaria* blight. The easily available local organic manures could play a good role in sustainable agriculture. They help in eco – friendly disease management of the crop and these organic manures can be used as bio- fertilizers in cultivation of the rapeseed – mustard successfully.

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