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Interaction effect of fertility gradients and different levels of NPK combinations on disease severity of Leaf blotch in Potato under field conditions of West Bengal

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Leaf blotch of potato caused by *Cercospora concors* (Caspary) Sacc. is more common and recent alarming foliar diseases of potato in West Bengal condition. Leaf blotch disease severity (%) was reduced through different levels of NPK fertilizer combinations in diverse fertility gradients of soil. Kufri jyoti was selected as test variety for the experiment. From the experiment it was found that the Leaf blotch disease severity of potato was significantly reduced in different treatment combinations compared to control (untreated) plot.

Key words: *Cercospora concors*, Leaf blotch, disease severity, potato, NPK, soil fertility status

INTRODUCTION

Leaf blotch of potato or *Cercospora* leaf blotch disease of potato caused by *Cercospora concors* (Caspary) Sacc. and it occurs worldwide but mainly reported in the temperate climatic condition of Asia, Europe, North America and eastern Africa. Previously realized that, this disease is usually a minor disease or not economically importance but may go unnoticed. Since it commonly occurs simultaneously with other potato foliar diseases such as late blight and early blight, although it has been known and reported from Europe since 1854.

The infections were mostly observed on lower as well as middle leaves and 20-30% disease severity may appear in all potato growing belt areas in China (Tian *et al*, 2008). Morante, (2014), first reported that the severity and crop loss due to Cercospora Leaf blotch of potato ranged from 10-20% in Bolivia. However, it is very common and recent alarming foliar diseases of potato in India as well as in West Bengal. Studies on Leaf blotch of potato in West Bengal are mainly restricted to the yearly occurrence of the disease and it depends on the effect of soil fertility, environmental conditions and management of the disease by spraying with fungicides. Timely and judicious application of fungicides is necessary for management of the disease. The knowledge of plant nutrition with the relationship of plant disease provides a basis for modifying current agricultural practices to reduce disease severity in integrated crop production management.

Farmers generally apply fertilizers without testing of the fertility status of the soil and also have little knowledge on the other aspects of the disease development. The uneven accumulation of fertilizer in different regions leads the potato crop towards infection by various fungal diseases such as early blight, late blight and leaf blotch diseases of potato. Nutritional status of the soil is also an important factor for disease severity for viable and accurate prediction. In this paper an attempt has been made on this line.

MATERIALS AND METHODS

The experiment was conducted at Regional Re-

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search Farm, Bidhan Chandra Krishi Viswavidyalya (B.C.K.V), Gayeshpur, Nadia,West Bengal during the *rabi* (dry) season of 2003-06. The research Farm is located at an elevation of 9.75 msl and the latitude and longitude are 23.5^0N and 89.5^0E respectively. The soil of the experimental field is sandy loam in texture with good water holding capacity. The main field consisted of four equal strips, gross plot area of the 4 (strips) fertility gradient soil were 2000 sq.m and each strip area was equal i.e. 500 sq.m and each of the plot was separated by one-meter irrigation channel. Before Potato sowing, soil samples were collected from 15 cm. depths of soil from the 12 treatments and one control ($S_0N_0P_0K_0$) or untreated plot under each strip and analyzed for pH, organic C, N, P and K by the method of Jackson (1973) and available mean nutrients of initial soil of the three year data are presented in Table 1.

Layout and Design of the Experiment

The experiment was carried out after creation of fertility gradients, for experimentation of potato leaf blotch disease, in a split plot design with three (3) replications. Four different fertility gradients of soil were made then each gradient of soil divided into 13 sub plots or treatments per replication, covering an area of sub plot was 12 sq. m. (4m x 3m), the fertilizers applied to potato under different strips in 12 NPK combinations of treatment and one control (untreated) before the sowing of potato. Potato tubers were planted on 20^{th} -21^{st} Nov. in the respective years and the spacing between row to row and plant to plant was 50cm x15cm.

Treatments combination follows

The treatments of fertilizers per hectare are as applied. For this purpose, three levels of N (150, 200 and 250 Kg ha^{-1}) two levels of P_2O_5 (125 and150 Kg ha^{-1}) and K_2O (125 and150 Kg ha^{-1}) were applied as source of urea, single super phosphate and muriate of potash at the time of sowing. Treatment combinations arranged in below:

$T_1(N_{150}P_{125}K_{125})$;$T_2(N_{150}P_{125}K_{150})$;$T_3(N_{150}P_{150}K_{125})$;$T_4(N_{150}P_{150}K_{150})$;
$T_5(N_{200}P_{125}K_{125})$;
$T_6(N_{200}P_{125}K_{150})$;$T_7(N_{200}P_{150}K_{125})$;$T_8(N_{200}P_{150}K_{150})$;$T_9(N_{250}P_{125}K_{125})$;
T_{10} $(N_{250}P_{125}K_{150})$;
T_{11} $(N_{250}P_{150}K_{125})$; T_{12} $(N_{250}P_{150}K_{150})$; T_{13} $(N_0P_0K_0)$.

All the experimental plots were uniformly fertilized. Half of N total P and K were placed as basal dose during final land preparation and the rest half of nitrogen was top-dressed after the first ear thing up, 35 days after sowing. Only 10 plants per plot and per replication selected for recorded of leaf blotch disease infestation. Systemic insecticides i.e. Imidachloprid 17.8% SL @ 3 ml/10 l of water sprayed to control the caterpillar as well as aphids in the experimental plot.

Disease incidence assessment

Percent of disease incidence calculated by using simple formula in below :

$$\text{Percentage of disease incidence} = \frac{\text{Number of infected plants}}{\text{Number of plants observed}} \times 100$$

Assessment of disease severity

For Leaf blotch disease severity, 10 plants per replication per treatment of plot were randomize selected by such standardized rating scale given by Mayee and Datar (1986) and then percent of disease index (PDI) or disease severity of this disease was calculated. The percent of disease index (PDI) was calculated by using the formula of the McKinney (1923).

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{Total no. of leaflets observed x maximum ratings}} \times 100$$

The percentage of disease severity of leaf blotch disease increase or decrease over control was calculated by using the formula as below:

$$\text{Percentage of disease Severity increase or decrease on over control} = \frac{\text{Value of Control plot - Value of the treated plot}}{\text{Control plot}} \times 100$$

Yield (tuber and biomass) of potato

The potato tubers were harvested on 22^{nd} -23^{rd} February in the three years respectively. The fresh weight of tubers and biomass per replication per plot were taken in kg ha^{-1} then converted to quintal ha^{-1} (except biomass wt.).

RESULTS AND DISCUSSION

Effect of different fertility gradients on Leaf blotch disease of potato

Table 2 revealed that irrespective of different NPK treatments, the effect of different soil fertility gradients on potato Leaf blotch disease incidence and

Table 1: Available nutrients of soil, before potato sowing (Pooled data)

Strips (Key words)	pH	Organic C (%)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)
S_1	6.3	0.514	278.3	9.9	80.3
S_2	6.2	0.450	290.1	22.9	97.0
S_3	6.5	0.444	301.8	26.6	213.5
S_4	6.3	0.493	316.4	37.1	282.8

Table 2 : Effect of different fertility gradients on Leaf blotch disease of potato

Different fertility gradient	Mean Disease incidence (%)	Mean disease Severity (%)
S_1 (Low fertility)	48.8 (43.2)*	6.2 (14.1)*
S_2 (Moderate fertility)	40.0 (39.1)	4.9 (12.4)
S_3 (Medium fertility)	41.7 (40.1)	5.2 (12.8)
S_4 (High fertility)	35.6 (36.5)	4.2 (11.5)
S.Em ±	0.032 (0.019)	0.012 (0.018)
CD (P=0.05)	0.095 (0.056)	0.036 (0.054)

severity were significantly differed in different fertility gradient of soil. The pooled mean of three years data showed that minimum disease incidence (35.6%) and severity (4.2 %) were observed in high fertility gradient soil followed by moderate fertility gradient soil (incidence = 40.0 %, severity = 4.9 %), medium fertility gradient soil (incidence= 41.7 %, severity = 5.2%) and low fertility gradient soil (incidence= 48.8 %, severity = 6.2%) respectively.

It was clearly indicated that with increased in fertility gradient of soil there was a significantly decrease in disease incidence as well as severity on Leaf blotch disease of potato and also positive relation were get on incidence and severity of the disease.

Different NPK combination treatments on Leaf blotch disease of potato

From this observation, it was found that irrespective of soil fertility gradients leaf blotch disease incidence and severity decreased with the increase of Nitrogen, Phosphorus and Potassium application (Table 2). The disease incidence (%) varied 28.3% to 59.0% and disease severity varied 2.2 to 11.4% during the investigation period in pooled mean of the three years respectively. Minimum disease (incidence=28.3% and severity =2.2 %) recorded in $N_{250}P_{150}K_{125}$ followed by $N_{250}P_{125}K_{150}$ (incidence= 30.4 % and severity =2.4%), $N_{250}P_{150}K_{150}$ (incidence= 32.8 % and severity= 2.4%) respectively. Maximum disease (incidence=59.0% and severity =11.4%) observed in control plot ($N_0P_0K_0$) (Table 3). So, it could be concluded that leaf blotch disease incidence along with severity significantly decreased with the higher doses of nitrogen (250 kg ha^{-1}), double dose of phosphorus (150 kg ha^{-1}) and single dose of potassium (125 kg ha^{-1}) applications. Similarly another observation that higher doses of nitrogen (250 kg ha^{-1}) with single dose of phosphorus (125 kg ha^{-1}) and double dose of potassium (150 kg ha^{-1}) applications were reduced the leaf blotch disease both incidence and severity followed by higher doses of nitrogen (250 kg ha^{-1}), double dose of phosphorus (150 kg ha^{-1}) and double doses of potassium (150 kg ha^{-1}) applications were significantly reduced the disease compare to control plot.

Table 3: Effect of different NPK combinations on Leaf blotch disease of potato

Different doses of NPK Combinations	Leaf blotch disease incidence (%)	Leaf blotch disease severity (%)
$N_{150}P_{125}K_{125}$	53.1(46.8)*	7.9(16.2)*
$N_{150}P_{125}K_{150}$	46.8(43.2)	6.2(14.3)
$N_{150}P_{150}K_{125}$	48.7(44.3)	6.5(14.7)
$N_{150}P_{150}K_{150}$	45.2(42.2)	6.9(15.2)
$N_{200}P_{125}K_{125}$	35.2(36.4)	4.0(11.5)
$N_{200}P_{125}K_{150}$	37.3(37.6)	4.0 (11.5)
$N_{200}P_{150}K_{125}$	41.1(39.9)	4.3 (11.9)
$N_{200}P_{150}K_{150}$	39.3(38.8)	4.5(12.2)
$N_{250}P_{125}K_{125}$	36.2(36.9)	3.7 (11.1)
$N_{250}P_{125}K_{150}$	30.4(33.4)	2.4 (8.9)
$N_{250}P_{150}K_{125}$	28.3(32.1)	2.2(8.4)
$N_{250}P_{150}K_{150}$	32.8(34.9)	2.7(9.5)
Control ($N_0P_0K_0$)	59.0(50.2)	11.4(19.7)
S.Em ±	0.049(0.029)	0.012(0.018)
CD (P=0.05)	0.136(0.080)	0.033(0.050)

*Figures in parentheses are angular transformed value

Effect of different NPK combinations under different fertility gradients on leaf blotch disease as well as yield attributes of potato

Generally, the nutrient requirement of potato is high because of their higher biological yield that reflected on the tuber yield (economical yield). For this purpose present study revealed that the interaction effect of different fertilizer doses and the occurrence of disease severity under different fertility gradients were varied and affected on tuber yield of potato in compare to control plot.

The low fertile (S_1) Soil stated that the maximum tuber yield and biomass weight ranged from 58.1 q ha^{-1} to 292.3 q ha^{-1} and 86.2 Kg ha^{-1} to 413.6 Kg ha^{-1} respectively where percent of mean disease reduction on over control i.e. 32.9 to 80.3%, percent of tuber yield increased on over control 243.7 to 403.1% and biomass weight increased on over control 192.7 to 379 % in different treatments combination and their difference statistically significant. The treatment $S_1N_{250}P_{150}K_{125}$ showed highest mean disease reduction (80.3%) on over control and maximum yield (tuber yield = 292.3 q/ ha and biomass weight = 413.6 Kg/ha) and proved to be best treatments that significantly increased yield on over control with mean 403.1% of tuber yield and 379.8% of biomass weight in the three consecutive years of 2003-04, 2004-05 and 2005-06 followed by the treatment $S_1N_{250}P_{125}K_{150}$ (tuber yield = 232.4 q/ha and biomass weight = 266.8 Kg/ ha) where mean disease reduction was 78.1 % and increased yield on over control with mean 300.0% of tuber yield and 209.5% of biomass weight were recorded followed by $S_1N_{250}P_{150}K_{150}$(tuber yield = 292.3 q/ha and biomass weight = 413.6 Kg/ha) where mean disease reduction was 78.1 % and increased yield on over control with mean 300.0% of tuber yield and 209.5% of biomass weight were recorded and proved to be second and third best treatment during the investigation period (Table 4).

In moderate fertility gradient (S_2) of soil, where the maximum tuber yield and biomass weight varied from 77.2 q ha^{-1} to 305.2 q ha^{-1} and 96.7 Kg ha^{-1} to 400.8 Kg ha^{-1} respectively where percent of mean disease reduction on over control ranged from 31.8 to 80.9%, percent of tuber yield increased on over control 203.6 to 295.5% and biomass weight increased on over control 151.7 to 314.5 % in different treatments combination and their difference statistically significant. The treatment $S_2N_{250}P_{150}K_{125}$ showed highest mean disease reduction (80.9%) on over control and yield attributes (tuber yield = 301.8 q/ha & biomass weight = 365.4 Kg/ha) and proved to be best treatments that significantly increased yield on over control with mean 291.1% of tuber yield and 277.9 % of biomass weight in the three consecutive years followed by the treatment $S_2N_{250}P_{125}K_{150}$ (tuber yield = 256.1 q/ha and biomass weight = 400.8 Kg/ha) where mean disease reduction was second best with 79.1 % and increased yield on over control with mean 231.8 % of tuber yield and 314.5% of biomass weight followed by $S_2N_{250}P_{150}K_{150}$ (tuber yield = 288.5 q/ha and biomass weight = 292.9 Kg/ ha) where mean disease reduction was third best with 78.1 % and increased yield on over control with mean 273.8 % of tuber yield and 202.9 % of biomass weight were recorded during the investigation period (Table 4).

In medium fertility gradient (S_3) of soil, where the maximum tuber yield and biomass weight varied from 80.6 q ha^{-1} to 339.4 q ha^{-1} and 125.4 Kg ha^{-1} to 609.1 Kg ha^{-1} respectively where percent of mean disease reduction on over control ranged from 31.4 to 80.5%, percent of tuber yield increased on over control 204.3 to 321.1% and biomass weight increased on over control 114.7 to 385.7 % in different treatments combination and their difference statistically significant. As regard disease reduction, the treatment $S_3N_{250}P_{150}K_{125}$ showed highest mean disease reduction (80.5%) on over control and optimum yield (tuber yield = 312.9 q/ha and biomass weight = 510.7 Kg/ha) and proved to be best treatments that significantly increased yield on over control with mean 288.3 % of tuber yield and 307.3 % of biomass weight in the three consecutive years followed by the treatment $S_3N_{250}P_{125}K_{150}$ (tuber yield = 289.2 q/ha & biomass weight = 444.6 Kg/ha) where mean disease reduction was second best with 79.7 % and increased yield on over control with mean 258.9 % of tuber yield and 254.6 % of biomass weight were recorded followed by $S_3N_{250}P_{150}K_{150}$ (tuber yield = 336.8 q/ha and biomass weight = 609.1 Kg/ha) where mean disease reduction was third best with 75.4 % and increased yield on over control with mean 317.8 % of tuber yield and 385.7 % of biomass weight were recorded during the investigation period (Table 4).

Similarly in high fertility gradient (S_4) of soil, where the maximum tuber yield and biomass weight varied from 106.2 q ha^{-1} to 340.4 q ha^{-1} and 188.9 Kg ha^{-1} to 771.8 Kg ha^{-1} respectively where percent of mean disease reduction on over control ranged from 28.0 to 82.8 %, percent of tuber yield increased on over control 152.2 to 220.4 % and biomass weight increased on over control 158.1 to 308.6 % in different treatments combination and their difference statistically significant. The treatment $S_4N_{250}P_{150}K_{125}$ showed highest mean disease reduction (82.8%) on over control and optimum yield (tuber yield = 340.4 q/ha and biomass weight = 701.2 Kg/ha) and proved to be best

Table 4 : Effect of different NPK combinations along with fertility gradients on Leaf blotch disease and on yield attributes of potato

Treatments	Disease severity pooled mean		Yield attributes of potato pooled mean			
	Disease severity (%)	% disease reduction on over control	Tuber yield (q/ha)	% Tuber yield increase on over control	Biomass fresh weight (Kg/ha)	% Biomass fresh weight increase on over control
$S_1N_{150}P_{125}K_{125}$	9.2(17.8)*	32.9	199.7	243.7	282.1	227.3
$S_1N_{150}P_{125}K_{150}$	7.2(15.6)	47.5	243.8	319.6	316.3	266.9
$S_1N_{150}P_{150}K_{125}$	7.5(15.9)	45.3	253.8	336.8	324.7	276.7
$S_1N_{150}P_{150}K_{150}$	7.9(16.4)	42.3	237.7	309.1	310.9	260.7
$S_1N_{200}P_{125}K_{125}$	5.3(13.3)	61.3	228.2	292.8	252.3	192.7
$S_1N_{200}P_{125}K_{150}$	5.3(13.3)	61.3	226.2	289.3	296.0	243.4
$S_1N_{200}P_{150}K_{125}$	5.4(13.5)	60.6	237.6	308.9	344.9	300.1
$S_1N_{200}P_{150}K_{150}$	5.4(13.5)	60.6	256.9	342.1	349.6	305.6
$S_1N_{250}P_{125}K_{125}$	4.5(12.3)	67.2	270.3	365.2	399.8	363.8
$S_1N_{250}P_{125}K_{150}$	3.0(10.0)	78.1	232.4	300.0	266.8	209.5
$S_1N_{250}P_{150}K_{125}$	2.7(9.4)	80.3	292.3	403.1	413.6	379.8
$S_1N_{250}P_{150}K_{150}$	3.4(10.6)	75.2	273.5	370.7	325.0	277.0
$S_1N_0P_0K_0$	13.7(21.7)	---	58.1	---	86.2	---
$S_2N_{150}P_{125}K_{125}$	7.5(15.9)	31.8	234.3	203.6	243.4	151.7
$S_2N_{150}P_{125}K_{150}$	5.9(14.0)	46.4	260.0	236.8	271.0	180.3
$S_2N_{150}P_{150}K_{125}$	6.3(14.5)	42.7	260.4	237.5	357.8	270.0
$S_2N_{150}P_{150}K_{150}$	6.8(15.1)	38.2	235.0	204.5	325.8	236.9
$S_2N_{200}P_{125}K_{125}$	3.7(11.0)	66.4	277.6	259.6	295.6	205.7
$S_2N_{200}P_{125}K_{150}$	3.6(11.0)	67.3	305.2	295.5	354.5	266.6
$S_2N_{200}P_{150}K_{125}$	3.9(11.4)	64.6	260.6	237.6	337.9	249.4
$S_2N_{200}P_{150}K_{150}$	4.3(11.9)	60.9	270.7	250.7	269.1	178.3
$S_2N_{250}P_{125}K_{125}$	3.7(11.1)	66.4	259.1	235.7	354.1	266.2
$S_2N_{250}P_{125}K_{150}$	2.3(8.8)	79.1	256.1	231.8	400.8	314.5
$S_2N_{250}P_{150}K_{125}$	2.1(8.3)	80.9	301.8	291.1	365.4	277.9
$S_2N_{250}P_{150}K_{150}$	2.6(9.3)	76.4	288.5	273.8	292.9	202.9
$S_2N_0P_0K_0$	11.0(19.4)	---	77.2	---	96.7	---
$S_3N_{150}P_{125}K_{125}$	8.1(16.5)	31.4	245.3	204.3	269.2	114.7
$S_3N_{150}P_{125}K_{150}$	6.4(14.7)	45.8	311.3	286.2	282.9	125.6
$S_3N_{150}P_{150}K_{125}$	6.8(15.1)	42.4	278.2	245.2	575.3	358.8
$S_3N_{150}P_{150}K_{150}$	7.1(15.4)	39.8	316.2	292.3	561.0	347.4
$S_3N_{200}P_{125}K_{125}$	3.9(11.3)	67.0	285.6	254.4	409.0	226.2
$S_3N_{200}P_{125}K_{150}$	3.8(11.3)	67.8	277.8	244.7	299.4	138.8
$S_3N_{200}P_{150}K_{125}$	4.1(11.7)	65.3	339.4	321.1	363.6	190.0
$S_3N_{200}P_{150}K_{150}$	4.4(12.2)	62.7	336.0	316.9	462.1	268.5
$S_3N_{250}P_{125}K_{125}$	3.8(11.2)	67.8	285.4	254.1	597.7	376.6
$S_3N_{250}P_{125}K_{150}$	2.4(8.9)	79.7	289.2	258.9	444.6	254.6
$S_3N_{250}P_{150}K_{125}$	2.3(8.6)	80.5	312.9	288.3	510.7	307.3
$S_3N_{250}P_{150}K_{150}$	2.9(9.9)	75.4	336.8	317.8	609.1	385.7
$S_3N_0P_0K_0$	11.8(20.1)	---	80.6	---	125.4	---
$S_4N_{150}P_{125}K_{125}$	6.7(15.0)	28.0	313.9	195.5	487.5	158.1
$S_4N_{150}P_{125}K_{150}$	5.1(13.1)	45.2	298.7	181.1	494.3	161.7
$S_4N_{150}P_{150}K_{125}$	5.4(13.5)	41.9	289.4	172.4	622.3	229.4
$S_4N_{150}P_{150}K_{150}$	5.8(13.9)	37.6	267.9	152.2	554.4	193.5
$S_4N_{200}P_{125}K_{125}$	3.2(10.3)	65.6	308.8	190.6	557.1	194.9
$S_4N_{200}P_{125}K_{150}$	3.4(10.6)	63.4	315.5	197.0	730.8	286.9
$S_4N_{200}P_{150}K_{125}$	3.6(11.0)	61.3	303.5	185.6	616.6	226.4
$S_4N_{200}P_{150}K_{150}$	3.9(11.4)	58.1	298.9	181.3	688.6	264.5
$S_4N_{250}P_{125}K_{125}$	2.9(9.9)	68.8	271.9	155.9	730.5	286.7
$S_4N_{250}P_{125}K_{150}$	1.8(7.8)	80.7	337.9	218.1	771.8	308.6
$S_4N_{250}P_{150}K_{125}$	1.6(7.5)	82.8	340.4	220.4	701.2	271.2
$S_4N_{250}P_{150}K_{150}$	2.0(8.3)	78.5	335.9	216.1	617.2	226.7
$S_4N_0P_0K_0$	9.3(17.9)	---	106.2	---	188.9	---
S.Em ±	0.025(0.036)	---	4.577	---	1.391	---

*Figures in parentheses are angular transformed value

$S_{1=}$ Low fertility gradient soil, $S_{2=}$ Moderate fertility gradient soil. $S_{3=}$ Medium fertility gradient soil and $S_{4=}$ High fertility gradient soil treatments that significantly increased yield on over control with mean 220.4 % of tuber yield and 271.2 % of biomass weight in the three consecutive years followed by the treatment $S_4N_{250}P_{125}K_{150}$ (tuber yield = 337.9 q/ha and biomass weight = 771.8 Kg/ha) where mean disease reduction was second best with 80.7 % and increased yield on over control with mean 218.1% of tuber yield and 308.6 % of biomass weight were recorded followed by $S_4N_{250}P_{150}K_{150}$ (tuber yield = 335.9 q/ha and biomass weight = 617.2 Kg/ha) where mean disease reduction was third best with 78.5 % and increased yield on over control with mean 216.1 % of tuber yield and 226.7 % of biomass weight were recorded during the investigation period and that were presented in the Table 4.

From the above discussion the disease severity was significantly reduced in different treatment combinations compared to control (untreated) plot. So it could be concluded that higher doses of nitrogen (250 kg ha^{-1}), double dose of phosphorus (150 kg ha^{-1}) and single dose of potassium (125 kg ha^{-1}) applications followed by higher doses of nitrogen (250 kg ha^{-1}) with single dose of phosphorus (125 kg ha^{-1}) and double dose of potassium (150 kg ha^{-1}) applications were reduced the leaf blotch disease followed by another significant treatments i.e. higher doses of nitrogen (250 kg ha^{-1}), double dose of phosphorus (150 kg ha^{-1}) and double dose of potassium (150 kg ha^{-1}) applications significantly reduced of the leaf blotch disease compare to control plot. As regard yield attributes it also noted that the high fertility gradient soil recorded the maximum yield and minimum yield obtained in low fertility gradient of soil along with application of higher doses of nitrogen levels and higher doses of phosphate level as well as potassium levels. Whereas, tuber yield in moderate and medium fertility gradient soil also differed and their difference were statistically significant. So it revealed that the nutrition factors strongly interfere on disease severity as well as on tuber yield of potato.

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