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# Management of wilt diseases of linseed (*Linum usitatissimum* L.) under *in-vivo* condition caused by *Fusarium oxysporum* f.sp. Lini

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**Abstract**
A field experiment was conducted during rabi 2018-19 and 2019-2020 in alluvial soil at student research farm pili kothi, T.D.P.G. College, Jaunpur. To assess the plant disease incidence and response of different fungicides in controlling the disease and its effect on different yield contributing character. Nine treatments were taken constituting one check. The minimum PDI in 2018-19 was found in treatment treatment first (23.83). The maximum PDC in year 2018-19 was found in treatment first (62.15). In yield contributing character during 2018-19, the maximum plant population was found in treatment first and three (258.33), seed yield (kg./ha.) found maximum in treatment first (0.966), the maximum thousand grain weight (gm.) was found in treatment first (9.10), avoidable yield loss was found maximum in treatment first (55.27), the maximum benefit cost ratio was found in treatment first (0.88).
In 2019-20 The minimum PDI were found in treatment treatment first (25.01). The maximum PDC treatment first (45.10). Yield contributing character maximum plant population was found in treatment first, three, four, six, (250), seed yield (kg./ha.) found maximum in treatment first (0.95), the maximum thousand grain weight (gm.) was found in treatment first (9.30), avoidable yield loss was found maximum in treatment first (59.12), the maximum benefit cost ratio was found in treatment first (0.88). During course of investigation following all the technical programme the result shows for manging the wilt disease in linseed one has to follow the seed treatment Raxil and Vitavax, which also enhances the yield.

**Keywords:** *in-vivo,* linseed, wilt, fungicides, percent disease incidence, percent disease control, yield contributing character

## Introduction
Linseed, (*Linum usitatissimum* L.) is one of the oldest oilseed crop known as poor man's crop in India. It has got special importance amongst oilseed crop in rabi and has also been called as 'Alsi', also known with the local name as 'Tisi', 'Mosina' and 'Arise' in India. The oldest regions of linseed cultivation are reported to be in Asia and on the Mediterranean coast. Linseed is extensively grown in countries of the temperate zone as well as in those of the tropical zone. Linseed occupies a greater importance among oilseed owing to its various uses and special qualities. It is grown mainly for seed used for extracting oil in rainfed conditions. The oil content of the seed varies from 33-47%. Linseed oil is an excellent dyening oil is used in manufacturing paints and varnishes, oilcloth, waterproof fabrics and linolenum and as edible oil in some areas. Linseed cake is very good manure and animal feed. Dual purpose linseed straw produces fibre of good quality. Linseed is also used in the manufacturing of the paper and plastics. Owig to development of improved linseed varieties and refinement of packages of practices for different situations of linseed cultivation, there has been a steady but slow increase in the yield of linseed over a long period. The national yield average for the quinquennium 1981-86 was 272 kg./ha., which increased to 293 kg./ha. by the next quinquennium of 1985-90. The present national average yield in year 2000 is 385 kg./ha.
Rainfed linseed is grown in 0.82 mha. In 281 districts of which 0.80 mha. Is under rainfed based on 1966-94 data in 16 states- Andhra Pradesh, Bihar, Jharkhand, Chattisgarh, Orissa, Madhya Pradesh, Maharashtra, Gujrat, Punjab, Hissar, Uttaranchal, Uttar Pradesh, Rajasthan, Karnataka, Tamilnadu and West Bengal covering arid semi-arid and dry sub-humid regions. About 85% of the area (0.66 mha.) is grown in 42 districts. In India, linseed is grown on an area of 2,96,000 ha with ha production of 1,49,000 tonnes and productivity of 503Kg/ha. Where as in Maharashtra it is grown on 27,000 ha, with production of 293 kg/ha.

(DAC&FW, 2018). The production of linseed in Uttar Pradesh during 2017-18 was 602 kg./ha. (DAC&FW, 2018) There are many fungal diseases which affect the production of linseed worldwide viz., Fusarium wilt (*Fusarium oxysporum* f.p. lini), Rust (Melampsora/ini), Powdery mildew (*Oidium lini* Skorik), Altemaria blight (*Altemaria linicola*), Foot rot (*Rhizoctonia solani*, *Pythium* spp), Damping off of seedling (*Pythium* sp.) etc. The early work on flax wilt was started in the United States in 1889 by Lugger, a biologist in the Minnesota, Agricultural Experiment Station.

**Material and Methods**

For evalution of different fungicides against wilt disease and yield contributing character under *in-vivo* condition the studies were conducted at Student Research Farm Pili Kothi T.D.P.G. College, Jaunpur Uttar Pradesh. Pili kothi is located in the Indo-Gangetic plains of eastern Uttar Pradesh at latitude 82° 41' 44'', longitude 25° 43' 30" and 76m above the sea level. Field trials were conducted during *Rabi* 2018-19 and 2019-2020.

Effect of seed treatment with fungicide and bio-agent on disease incidence. To screen the suitability of certain fungitoxicants (Thiram, Bavistin, Captan) and bio agent (*Trichoderma*) are used in *In-Vivo* for the management of disease. The seed of susceptible variety will be sown in each plots. The experiment was conducted at student researcg farm pili kothi T.D.P.G. Collage, Jaunpur with the following technical programme:

Variety : Chambal
Treatment : 09
Replication : 3
Design : R.B.D
Plot size : 3x2 meter
Spacing **:** 10x10 cm.

**Treatments**

$T_1$ : Seed treatment with Raxil @ 2 gm/kg. of seed.
$T_2$ : Seed treatment with Vitavax @ 2 gm/kg. of seed.
$T_3$ : Seed treatment with Propiconazole @ 2 gm/kg. of seed.
$T_4$: Seed treatment with Hexaconazole @ 4 gm/kg. of seed
$T_5$ : Neem
$T_6$ : Tulsi
$T_7$ : Panchagavya
$T_8$ : Trichoderma
$T_9$ : Control

**Observation will be recorded**

- Percent disease incidence in each treatments.
- Seed yield kg./Plot (q/ha.).
- Thousand grain weight (gram).
- Percent avoidable yield loss.
- Benefit Cost Ratio.

**Percent disease incidence**

Percent disease incidence is the number of plant infected by *Fusarium* wilt in each treatments. The PDI is calculated by screening the number of infected plant in $1m^2$ with the number of healthy plants.

The per cent disease intensity (PDI) was calculated by using the formula:

$$PDI = \frac{\text{Disease in control plot - Disease in treatme nt plot}}{\text{Disease in control plot}} \times 100$$

**Seed yield kg./Plot (q/ha.):** Yield of each plot is taken by weighing the produce of economic yield after harvesting the crop which was measured in kg. After recording yield of each plot then summed to take out total yield from net sown area.

**Thousand grain weight (gram):** Thousand grain weight is taken by weighing one thousand seed of linseed from each plot the actual weight of one thousand seed is noted and as such all the plot is evaluated.

**Percent Avoidable Yield Loss:** This is the difference between the yields obtained from protected and unprotected fields. The plant protection schedule adopted in protected fields may vary from crop to crop depending on the occurrence of different disease. Avoidable yield loss are calculated by the following formula:

$$AYL = \frac{YP - YU}{YP} \times 100$$

Where,
YP = Yield under protected conditions
YU = Yield under unprotected conditions

**Benefit: cost ratio:** Yield per plot was recorded in each treatment separately and yield per hectare was calculated to see the difference in the yield of individual treatment. The cost of each treatment and net return was calculated. Benefit cost ratio was calculated as under-

$$\text{Benefit cost ratio} = \frac{\text{Net return (Rs./ha)}}{\text{Total cost (Rs./ha)}}$$

**Seed treatment of fungicides and bio-agent**

The seed treatment was initiated before sowing of the seed. The treatments were formed on the basis of recommended doses of the agents. Which where separately mixed according to the given doses as planned in the technical programme

**Statistical analysis**

The statistical analysis of field experiment was done by the method randomized block design (RBD) prescribed by Wilk (1955). The significance of treatment difference was tested by variance ratio test at 5 per cent level of probability.

**Result and Discussion**

The result consists the description of Yield contributing character the yield contributing includes Plant Population, Seed Yield, Thousand Grain weight Avoidable yield Loss and Benefit Cost Ratio. Percent Disease Incidence and Percent Disease Control. The data which were collected is of two year 2018-19 and 2019-20. In year 2018-19 the yield contributing character the according to descending order are described as the maximum plant population was seen in treatment first and third and with similar population (258.33), the second was recorded in treatment fifth and eigth with same population (250) followed by treatment two and six (225), four and seven (233.33) and nine (216). The seed yield (Kg./ha.) were recorded the maximum seed yield were recorded in treatment first (0.966), followed by treatment Seven (0.763) treatment sixth (0.763), treatment five (0.716), treatment three (0.650), Treatment two (0.613), treatment four (0.606), treatment eight (0.53), treatment nine (0.166). The minimum seed yield was found in treatment treatment eight (0.53). The C.D. at 5% was

found 0.026 and SEM value was found 0.002. The thousand grain weight (gm.) in year 2018-19 was found mximum in treatment first (9.10) followed by treatment seven (8.26), treatment six (7.90), treatment five (7.43), treatment three (7.23), treatment four (6.83), treatment two (6.36), treatment eight (6.30), treatment nine (4.06). The minimum thousand grain weight was found in treatment eight (6.30). The C.D. at 5% was found 0.40 and SEM value was found 0.056. The avoidable yield loss in year 2018-19 was found maximum in treatment first (55.27) followed by treatment seven (50.79), treatment six (48.88), treatment five (45.27), treatment three (43.72), treatment four (40.44), treatment two (36.10), treatment eight (35.32), treatment nine (0.00). The least avoidable yield loss was recorded in treatment eight (35.32). The C.D. at 5% level of significance was found significant (3.40) and SEM (3.87). The benefit cost ratio in 2018-19 was found maximum in treatment first (0.88) and treatment six (0.69), treatment seven (0.69) followed by treatment five (0.65), treatment three (0.59), treatment two (0.55), treatment four (0.55), treatment one (0.48), treatment nine (0.10). The minimum benefit cost ratio was found in treatment eight (0.48). The C.D. at 5% level of significance was found significant (0.028) and SEM value (0.13). The average percent disease incidence in year 2018-19 was maximum in treatment nine (63.77) followed by treatment four (29.46), treatment eight (28.34), treatment five (27.17), treatment three (27.04), treatment two (26.90), treatment six (26.67), treatment seven (24.55), treatment first (23.83). The maximum PDI was found in treatment four (29.46). The C.D. at 5% level of significance was found (3.04) and SEM value (3.28). Percent Disease Control in year 2018-19 was found maximum in treatment first (62.15), treatment seven (60.54), treatment six (57.83), treatment two (56.86), treatment three (56.61), treatment five (56.55), treatment eight (53.75), treatment four (52.85), treatment nine (0.00). The minimum PDC was found in treatment four (52.85). C.D. at 5% level of significance was found (3.44) and SEM value (4.67).

In year 2019-20 the yield contributing character which include plant population, seed yield (kg./ha.), Thousand grain weight (gm.), Avoidable yield loss and benefit cost ratio. The plant population was found maximum in treatment first (250), treatment three (250), treatment four (250), treatment six (250), followed by treatment two (225), treatment five (225), treatment seven (200), treatment eight (200), treatment nine (200). The maximum plant population was found in treatment first, treatment three, treatment four, treatment six (250). Seed yield (kg./ha.) was found maximum in treatment first (0.95), followed by treatment six (0.77), treatment seven (0.76), treatment five (0.72), treatment three (0.65), treatment two (0.63), treatment four (0.60), treatment eight (0.53), treatment nine (0.13). The minimum seed yield was found in treatment eight (0.53). The C.D. at 5% level of significance was found significant (0.021) and SEM value (2.35). The thousand grain weight (gm.) was found maximum in treatment first (9.30), followed by treatment seven (8.36), treatment six (7.93), treatment five (7.46), treatment three (7.33), treatment four (6.96), treatment two (6.36), treatment eight (6.30), treatment nine (3.80). The minimum thousand grain weight was found in treatment eight (6.30). The avoidable yield loss was found maximum in treatment first (59.12) followed by treatment seven (54.50), treatment six (52.07), treatment five (49.08), treatment three (48.14), treatment four (45.46), treatment two (40.29), treatment eight (39.75), treatment nine (0.00). The minimum avoidable yield loss was found in treatment eight (39.75). The treatment was found significant at C.D. 5% level of significance (2.46) and SEM (2.02). The benefit cost ratio was found maximum in treatment first (0.88) followed by treatment six (0.71), treatment seven (0.70), treatment five (0.66), treatment two (0.62), treatment three (0.61), treatment four (0.59), treatment eight (0.49), treatment nine (0.11). The minimum benefit cost ratio was found in treatment eight (0.49). The treatment found significant C.D. at 5% level of significance (1.64) and SEM (465.34). The percent disease PDI was found maximum in treatment nine (44.99) followed by treatment seven (34.66), treatment six (34.36), treatment four (33.43), treatment five (33.33), treatment three (32.17), treatment two (31.38), treatment eight (30.19), treatment first (25.01). The minimum PDI was found in treatment first (25.01). The treatments were found significant C.D. at 5% level of significance (1.69) and SEM (1.07). The percent disease control PDC was found maximum in treatment first (45.10) followed by treatment eight (33.02), treatment two (31.33), treatment three (29.30), treatment five (26.18), treatment four (25.59), treatment six (24.38), treatment seven (23.84), treatment nine (0.00). The maximum PDC was found in treatment first (45.10). The treatment was found significant C.D. 5% level of significance (3.57) and SEM (4.68).

**Table 1:** Yield Contributing Character (2018-19)

| S. No. | Treatments | Plant Population | Seed Yield Kg./ha. | Thousand Grain Weight (gm.) | AYL | Benefit Cost Ratio |
|---|---|---|---|---|---|---|
| 1. | Seed treatment with Raxil | 258.33 | 0.966 | 9.10 | 55.27 | 0.88 |
| 2. | Seed treatment with Vitavax | 225 | 0.613 | 6.36 | 36.10 | 0.55 |
| 3. | Seed treatment with Propiconazole | 258.33 | 0.650 | 7.23 | 43.72 | 0.59 |
| 4. | Seed treatment withHexaconazole | 233.33 | 0.606 | 6.83 | 40.44 | 0.55 |
| 5. | Neem | 250 | 0.716 | 7.43 | 45.27 | 0.65 |
| 6. | Tulsi | 225 | 0.763 | 7.90 | 48.88 | 0.69 |
| 7. | Panchgavya | 216 | 0.763 | 8.26 | 50.79 | 0.69 |
| 8. | Trichoderma | 233.33 | 0.53 | 6.30 | 35.32 | 0.48 |
| 9. | Control | 250 | 0.166 | 4.06 | 0.00 | 0.10 |
| C.D | | | 0.026 | 0.40 | 3.40 | 0.028 |
| SEM+ | | | 0.002 | 0.056 | 3.87 | 0.13 |

**Table 2:** Percent Disease Intensity (P.D.I.) and Percent Disease Control (P.D.C.) 2018-19

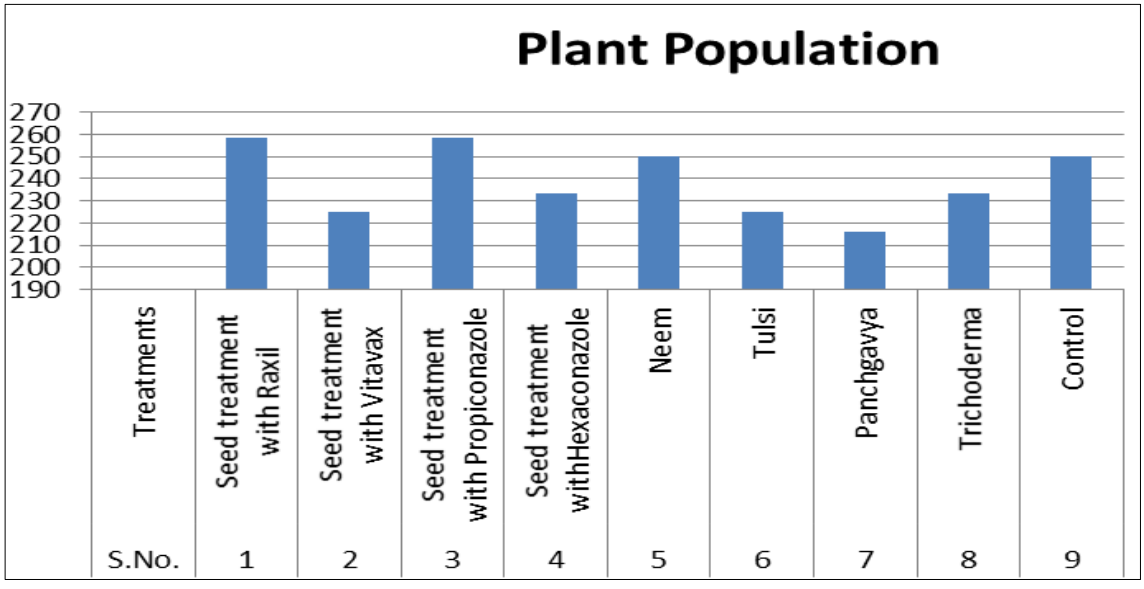
| S. No. | Treatments | Percent Disease Intensity (P.D.I.) | | | Avg. | Percent Disease Control (P.D.C.) | | | Avg. |
|---|---|---|---|---|---|---|---|---|---|
| | | 18/11/2018 | 05/12/2018 | 20/01/2018 | | 18/11/2018 | 05/12/2018 | 20/01/2019 | |
| 1. | Seed treatment with Raxil | 15.33 | 20.33 | 35.83 | 23.83 | 63.50 | 58.78 | 64.17 | 62.15 |
| 2. | Seed treatment with Vitavax | 16.66 | 25.00 | 39.06 | 26.90 | 60.33 | 49.32 | 60.94 | 56.86 |
| 3. | Seed treatment with Propiconazole | 16.66 | 25.33 | 39.15 | 27.04 | 60.33 | 48.65 | 60.85 | 56.61 |
| 4. | Seed treatment withHexaconazole | 18.33 | 27.00 | 43.06 | 29.46 | 56.35 | 45.26 | 56.94 | 52.85 |
| 5. | Neem | 17.00 | 24.66 | 39.87 | 27.17 | 59.52 | 50.01 | 60.13 | 56.55 |
| 6. | Tulsi | 15.33 | 24.66 | 40.02 | 26.67 | 63.50 | 50.01 | 59.98 | 57.83 |
| 7. | Panchgavya | 17.00 | 20.66 | 36.01 | 24.55 | 59.52 | 58.11 | 63.99 | 60.54 |
| 8. | Trichoderma | 16.33 | 30.33 | 38.36 | 28.34 | 61.11 | 38.51 | 61.64 | 53.75 |
| 9. | Control | 42 | 49.33 | 100 | 63.77 | 0.00 | 0.00 | 0.00 | 0.00 |
| C.D. | | 2.01 | 3.33 | 3.79 | 3.04 | 2.08 | 4.16 | 4.08 | 3.44 |
| SEM+ | | 1.35 | 3.70 | 4.79 | 3.28 | 1.32 | 6.57 | 6.12 | 4.67 |

**Table 3:** Yield Contributing Character (2019-20)

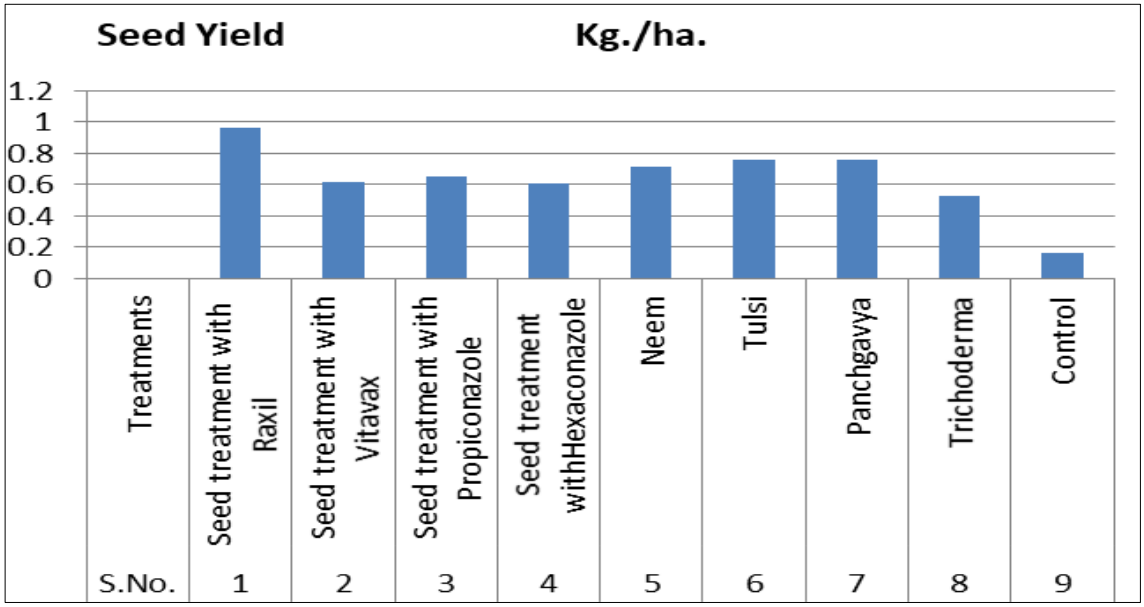
| S. No. | Treatments | Plant Population | Seed Yield Kg./ha. | Thousand Grain Weight (gm.) | AYL | Benefit Cost Ratio |
|---|---|---|---|---|---|---|
| 1. | Seed treatment with Raxil | 250 | 0.95 | 9.30 | 59.12 | 0.88 |
| 2. | Seed treatment with Vitavax | 225 | 0.63 | 6.36 | 40.29 | 0.62 |
| 3. | Seed treatment with Propiconazole | 250 | 0.65 | 7.33 | 48.14 | 0.61 |
| 4. | Seed treatment withHexaconazole | 250 | 0.60 | 6.96 | 45.46 | 0.59 |
| 5. | Neem | 200 | 0.72 | 7.46 | 49.08 | 0.66 |
| 6. | Tulsi | 250 | 0.77 | 7.93 | 52.07 | 0.71 |
| 7. | Panchgavya | 200 | 0.76 | 8.36 | 54.50 | 0.70 |
| 8. | Trichoderma | 250 | 0.53 | 6.30 | 39.75 | 0.49 |
| 9. | Control | 225 | 0.13 | 3.80 | 0.00 | 0.11 |
| C.D | | | 0.021 | 0.32 | 2.46 | 1.64 |
| SEM+ | | | 2.35 | 0.039 | 2.02 | 465.34 |

**Table 4:** Percent Disease Intensity (P.D.I.) and Percent Disease Control (P.D.C.) 2019-20

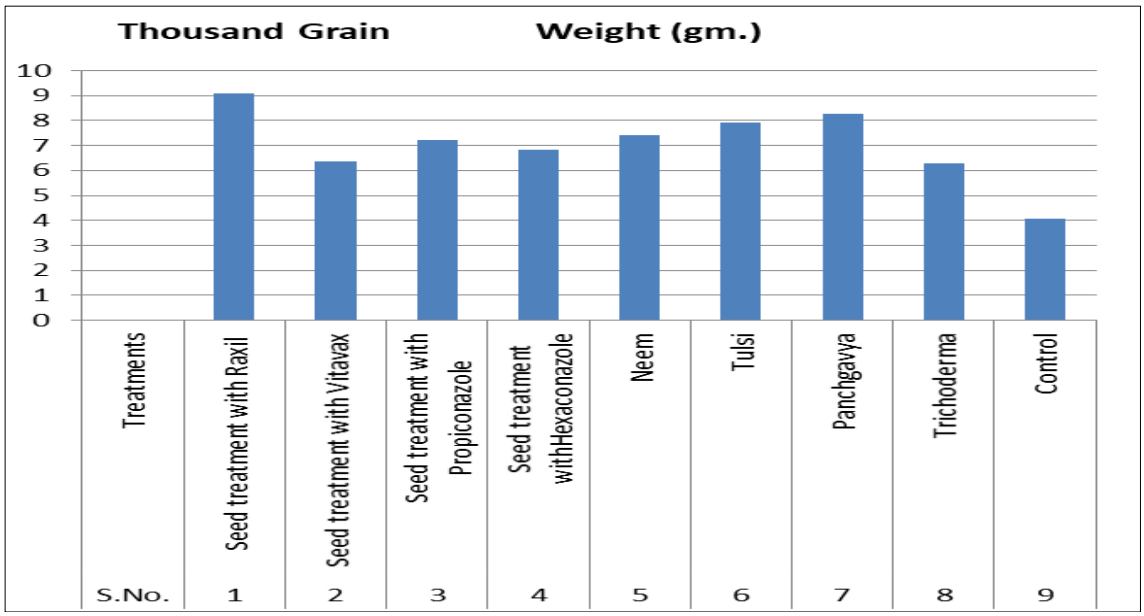
| S. No. | Treatments | Percent Disease Intensity (P.D.I.) | | | Avg. | Percent Disease Control (P.D.C.) | | | Avg. |
|---|---|---|---|---|---|---|---|---|---|
| | | 18/11/2018 | 05/12/2018 | 20/01/2019 | | 18/11/2018 | 05/12/2018 | 20/01/2019 | |
| 1. | Seed treatment with Raxil | 16.89 | 27.49 | 30.66 | 25.01 | 57.57 | 39.92 | 37.83 | 45.10 |
| 2. | Seed treatment with Vitavax | 23.99 | 35.16 | 35.00 | 31.38 | 39.73 | 25.15 | 29.11 | 31.33 |
| 3. | Seed treatment with Propiconazole | 26.96 | 27.91 | 41.66 | 32.17 | 32.27 | 39.08 | 16.55 | 29.3 |
| 4. | Seed treatment withHexaconazole | 28.50 | 35.13 | 36.66 | 33.43 | 28.40 | 22.68 | 25.69 | 25.59 |
| 5. | Neem | 26.51 | 35.83 | 37.66 | 33.33 | 33.42 | 21.51 | 23.63 | 26.18 |
| 6. | Tulsi | 24.16 | 38.26 | 40.66 | 34.36 | 39.32 | 16.28 | 17.55 | 24.38 |
| 7. | Panchgavya | 24.07 | 38.18 | 41.73 | 34.66 | 39.53 | 16.58 | 15.41 | 23.84 |
| 8. | Trichoderma | 20.67 | 33.64 | 36.26 | 30.19 | 48.10 | 24.46 | 26.50 | 33.02 |
| 9. | Control | 39.83 | 45.83 | 49.33 | 44.99 | 0.00 | 0.00 | 0.00 | 0.00 |
| C.D. | | 0.89 | 2.35 | 1.83 | 1.69 | 2.15 | 4.83 | 3.75 | 3.57 |
| SEM+ | | 0.26 | 1.84 | 1.12 | 1.07 | 1.55 | 7.81 | 4.69 | 4.68 |



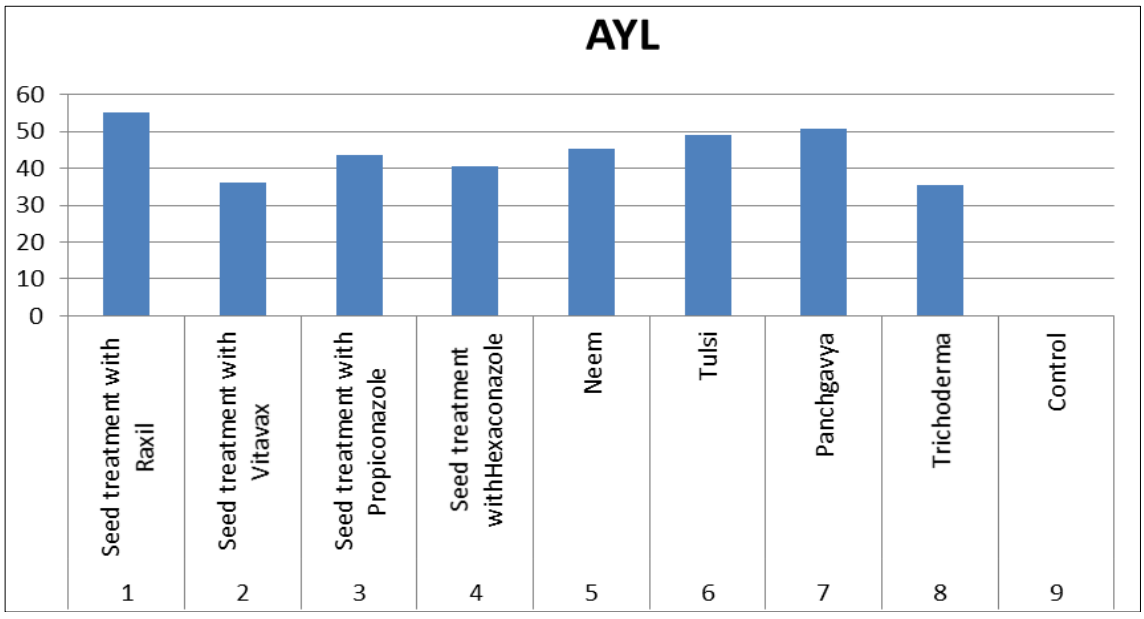

**Graph 1:** Plant population (2018-19)



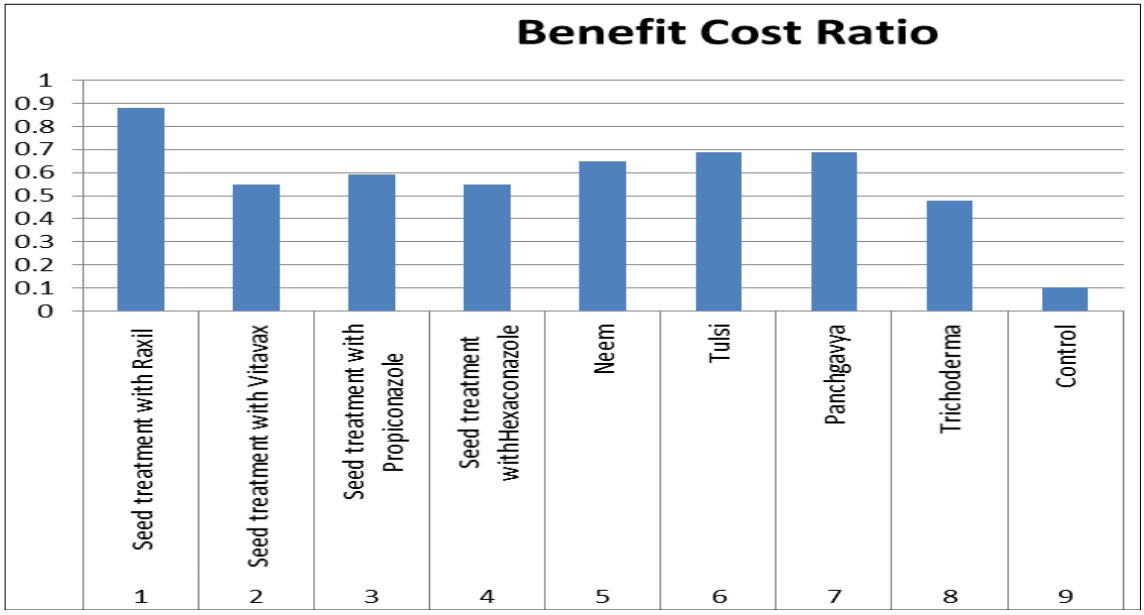

**Graph 2:** Seed Yield (2018-19)



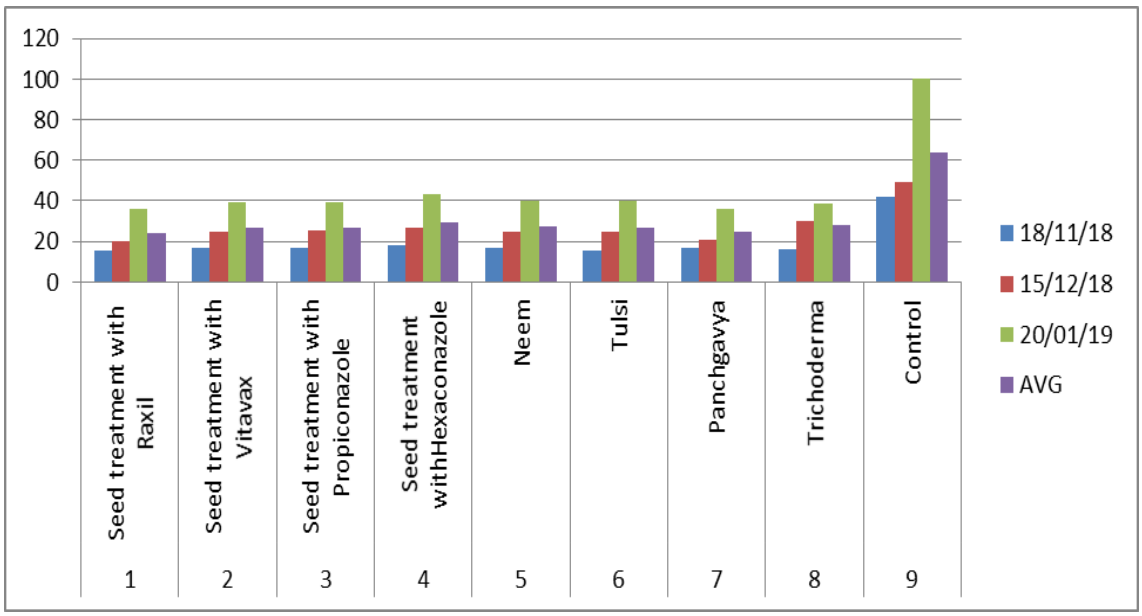

**Graph 3:** Thousand Grain Weight (2018-19)



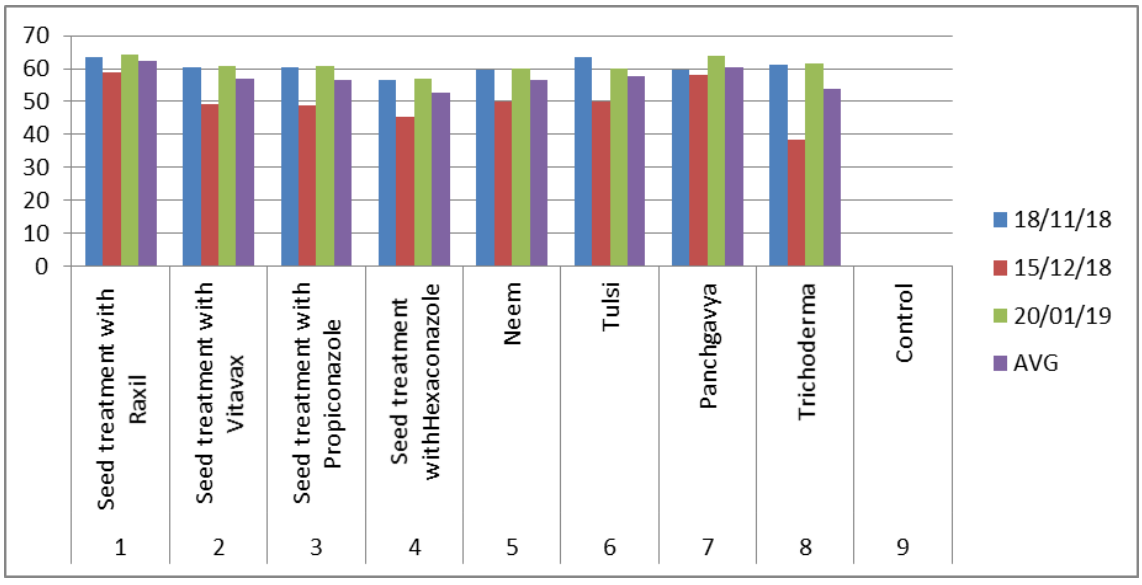

**Graph 4:** AYL (2018-19)



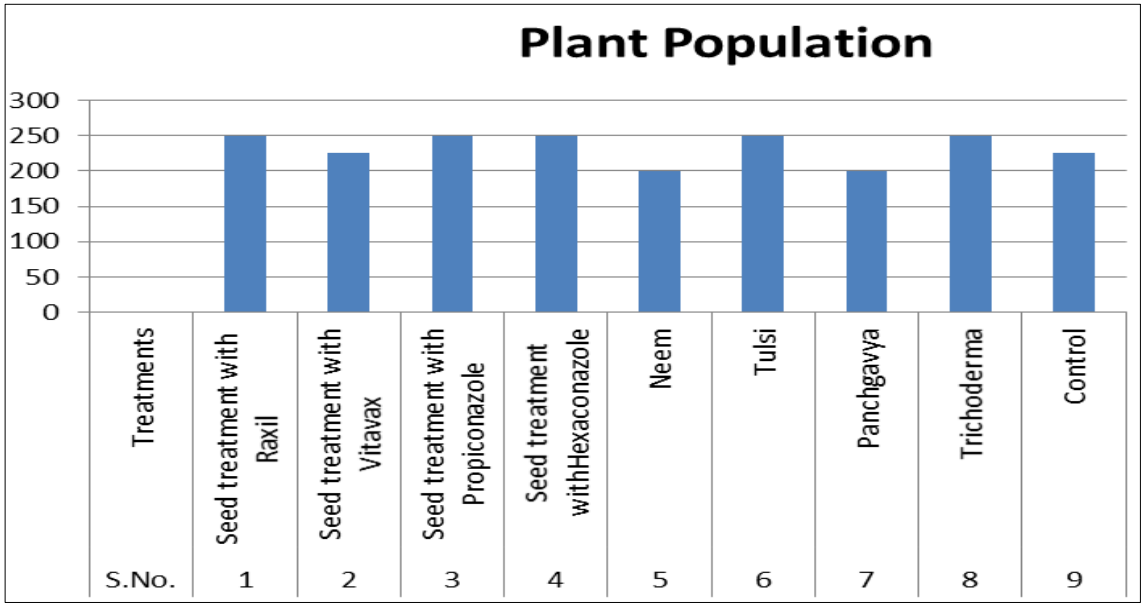

**Graph 5:** Benefit Cost Ratio (2018-19)



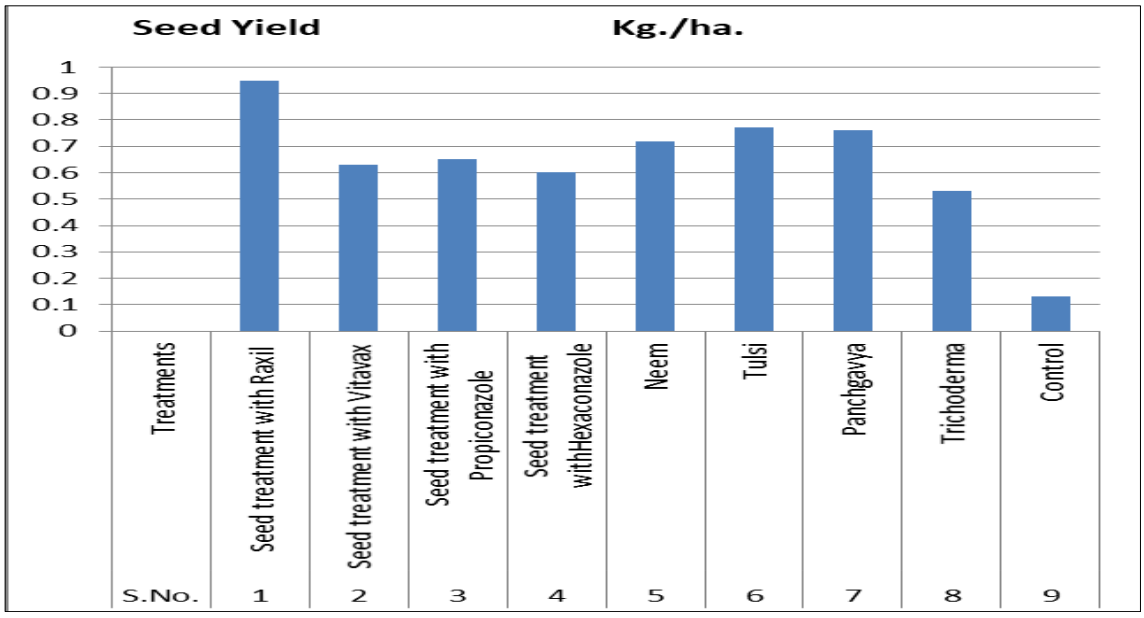

**Graph 6:** PDI (2018-19)



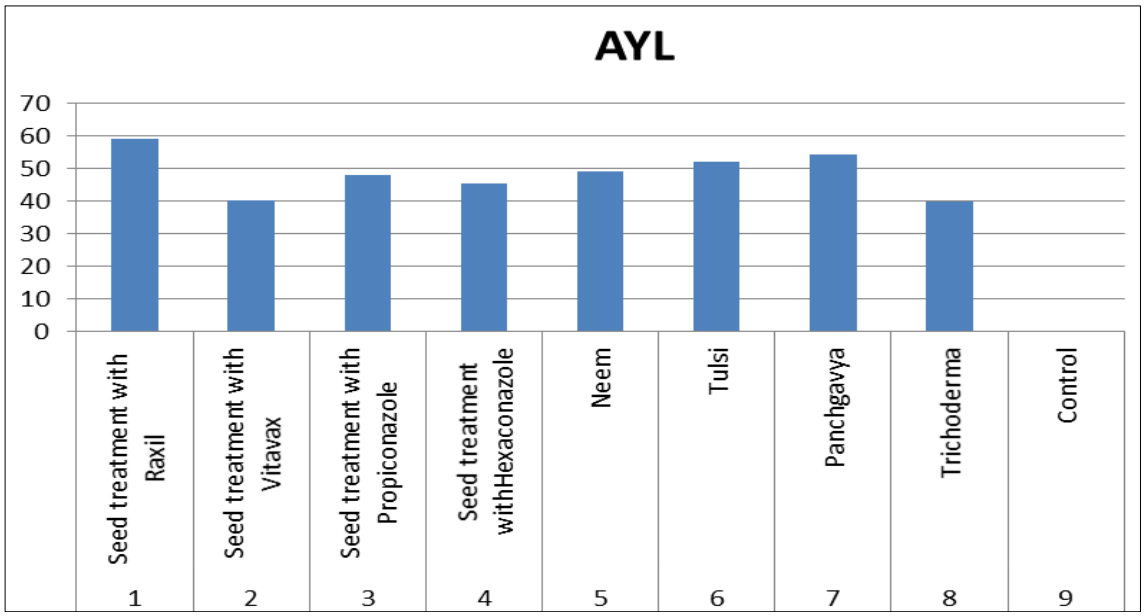

**Graph 7:** PDC (2018-2019)



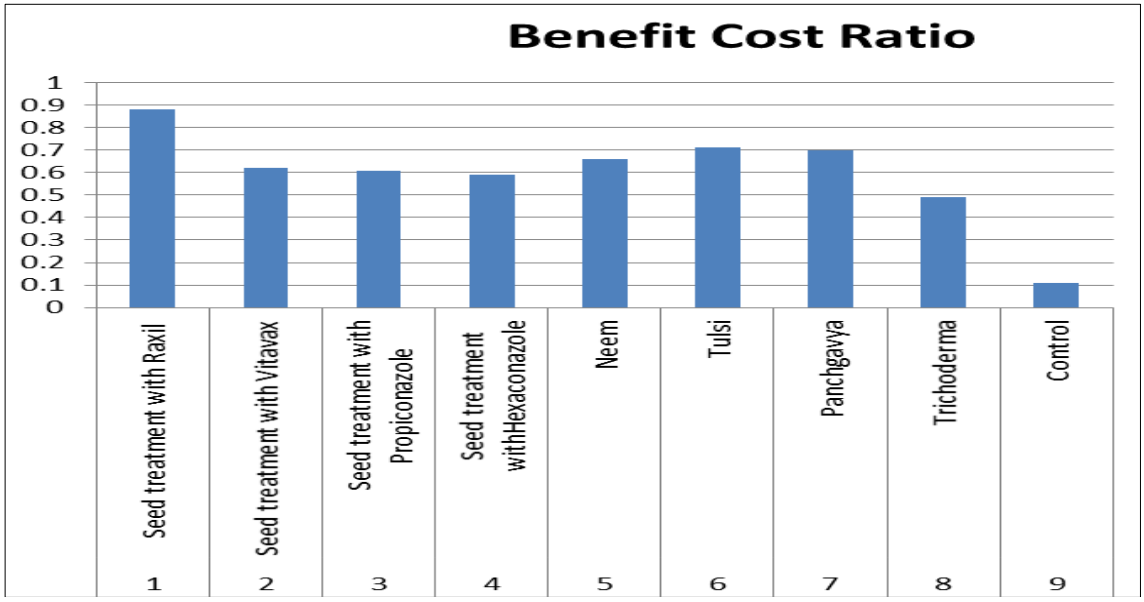

**Graph 8:** Plant Population (2019-20)



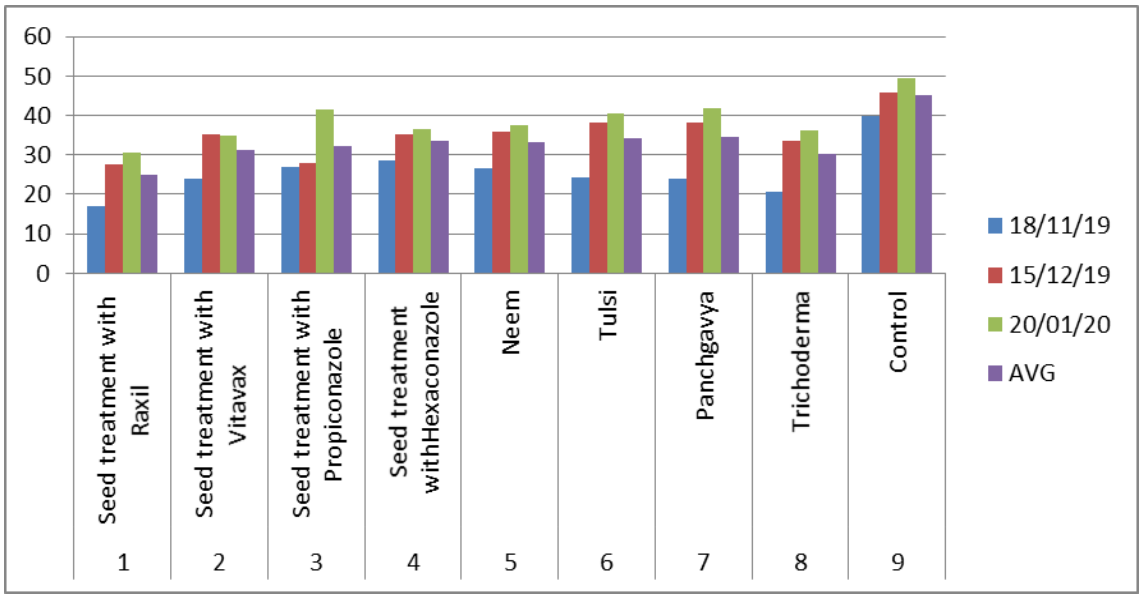

**Graph 9:** Thousand Grain Weight (2019-20)



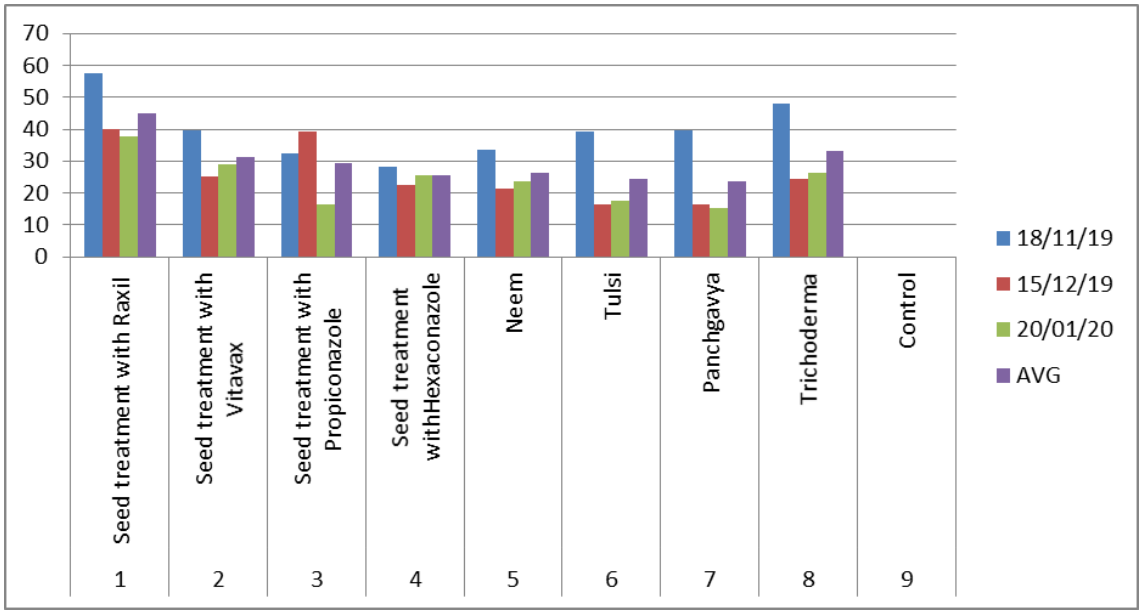

**Graph 10:** AYL (2019-20)




**Graph 11:** Benefit Cost Ratio (2019-20)




**Graph 12:** PDI (2019-20)




**Graph 13:** PDC (2019-20

## References

1. Luggar. In world the first report of this disease from Minnesota, USA, 1890.
2. (DAC&FW, 2018) a. Agricultural Satistics at a glance 2019.
3. (DAC&FW, 2018) b. Agricultural Satistics at a glance 2019.
4. Wilk MB. The Randomized Analysis of a Generalized Randomized Block Design. Biometrica 1955;42:70-79.
5. Sinha P, Rizvi G and Parashar R. Management of Wilt Disease of Pulses: A Review, Int. J. Pure App Biosci 2018;6(4):696-708.
6. Jamir Arshi And Ashraf Shabbir. Utilization of chemical fungicids in managing the wilt disease of chickpea caused by *Fusarium oxysporum* f. sp. *ciceri*. Archives of Phytopathology and Plant Protection 2020;53:876-898.
7. MD Bhimani, BB Golakiya and LF Akbari. Evaluation of different fungicides against fenugreek wilt (*Fusarium oxysporum* Schlecht.). International Journal of Chemical Syudies 2018;6(2):29-34.