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Effect of silicon and botanicals on growth, yellow mosaic viral disease of urdbean [*Vigna mungo* L.]

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Abstract
BLACK GRAM is an important cereal crop which is utilized as a human food as well as raw material for processing industries. However, yield losses are prominent due to the improper nutrient management practices. Hence the study was carried out on "Effect of Silicon and Botanicals on growth, Yellow Mosaic Viral disease of urdbean [*Vigna Mungo* L.]" Randomized Block Design (RBD) with three replications. T1-Control,T2-1.0 ml Silicon+ 2 foliar spray of Tinosporacardio folia @ 10%RDF, T3-1.5 ml Silicon+ 2 foliar spray of Tinosporacardio folia @ 10% RDF, T4-2.0 ml Silicon+ 2 foliar spray of Tinosporacardio folia @ 10% RDF, T50.5 ml Silicon + 2foliar sprya of Terminalia arjuna @ 10% RDF, T6 1.0 ml Silicon + 2foliar sprya of Terminalia arjuna @ 10% RDF T7 1.5 ml Silicon + 2foliar sprya of Terminalia arjuna @ 10% RDF T8 2.0 ml Silicon + 2foliar sprya of Terminalia arjuna @ 10% RDF, The treatment good results showed that, T4–(2.0 ml silicon + 2 foliar spray of Tinosporacardio folia @10% observed significant increase in all growth attributes.

Keywords: Silicon and botanicals on growth, yellow mosaic viral disease

Introduction
Urd been (*Vigna mungo* L. Hepper) Pulses are important crop grown in worldwide, which belongs to the family *Fabaceae*. India is a largest production country; annual production of urdbean in India is about 1.3 million tones. It is mainly used as 'dal' halwa and in preparation of many dishes in our diet. In southern parts of the country it is used in preparation of some special dishes. It is very rich source of protein containing about 25 per cent in its seeds and it is also richest in phosphoric acid among pulses. Besides it can also be used as green manure, this green fodder of Urdbean is very nutritive and is especially useful for milch cattle. It also acts as cover crop and its deep root system protects the soil from erosion. Urdbean being leguminous has the capacity to fix atmospheric nitrogen and thus helps in restoring the soil fertility. The High values of lysine make Urdbean an excellent complement to urdbeen in terms of balanced human nutrition. India is leading importer of pulses; Production of pulse/ legume crops has been stagnant over the years. Consequent upon this there is widening gap between demand and supply. Black gram is third important pulse crop of India and Gujarat state in particular among all the states. In India, black gram represents 18% (34.4 lakh hectares) of total pulse area and 11.48% (514 lakh tonnes) of pulse production.

Plant considered to be a silicon accumulator plant and tends to actively accumulate Si to tissue concentrations of 5% or higher. Recently Si has been regarded as quasi-essential element for the growth of higher plants (Epstein, 2002) [6]. Reduced amount of silicon in plant produces necrosis, disturbance in leaf photosynthetic efficiency, growth retardation and reduces grain yield (Shashidhar *et al*., 2008) [17]. Silicon has been found accumulating in shoots in the form of monosilicic acid. Low silicon uptake has been proved to increase the susceptibility to diseases (Akhtar *et al*., 2003 and Massey and Hartley, 2006) [1, 2]. Silicon is second most element abundantly available on earth crust. It's content in soils varies greatly ranging from lessthan 1 to 45% by dry weight Silicon, after oxygen, is the most abundant element in the earth's crust, with soils containing approximately 32 per cent Si by weight. Because of its abundance in the biosphere, the essentiality of Si as a micronutrient for higher plants is very difficult toprove. Although Si has n ot been recognized as an essential element of plant growth, the beneficial effects of silicon have been observed in wide variety of plant species. Agriculture activity tends to remove largequantities of Si from soil. Even highly purified water contains about 20nM Si (Werner and Roth, 1983) and correspondingly, the leaves of Si accumulator plants that were subjected to no silicon treatment usually contain between 0.5-1.9 mg Si g-1 leaf dry weight.

Silicon, after oxygen, is the most abundant element in the earth's crust, with soils containing approximately 32 per cent Si by weight Silicon enhances disease resistance in plants, imparts turgidity to the cell walls and has a purative role in mitigating the metal toxicities.

Materials and Methods

A field experiment on the "Effect of Silicon and Botanicals on growth and yield of Urd Bean Yellow Mosaic Viral disease [*Vigna Mungo* L.]" was conducted during *summer season* of 2018-2019, at the experimental farm of IFTM University, Lodhipur Rajput Delhi Road NH-24, Moradabad, Uttar Pradesh. The district Moradabad lies between 28º 21' to 28º 16' North latitude and 78. 4' to 79 East longitudes above mean sea level of (193.23) meters. The experimental plots have uniform topography with homogenous fertility and soil characteristics typical to suit BLACK GRAM crop cultivations. The fields were fairly leveled and had good drainage having assured irrigation facility. meters above mean sea level in the heart of the vast Indo-gangetic plains of India. The climate of this place is tropical to sub-tropical of slightly semi-arid in nature and is characterized by very dry summer, moderate rainfall and very cold winter. December and January are usually the coldest months where the mean temperature normally falls as low as 8.2 °C whereas; April and May are the hottest months, having the maximum average temperature of 40 °C. The normal rainfall is about 1407 mm (10 year average) which is unimodel type mostly precipitating during middle of June to middle of October, where potential evaporation transpiration is lower than the precipitation.

Growth characters

There observations were recorded at 20, 40 and, At harvesting time days after sowing and at the time of harvesting. Three plant were selected randomly in each plot and tagged for recording the various observations were also used to measure the plant height. The plant height were measured at 20,40 and at harvest, the mean was calculated to express the plant height of black gram in cm. DAS with the help of meter scale from the soil surface to the tip of full opened leaf. There observations were recorded at 20, 40 and, At harvesting time days after sowing and at the time of harvesting.

Plant height (cm)

Three plant were selected randomly in each plot and tagged for recording the various observations were also used to measure the plant height. The plant height were measured at 20,40 and at harvesting time Finally, the mean was calculated to express the plant height of black gram in cm. DAS with the help of meter scale from the soil surface to the tip of full opened leaf. Three plant were selected randomly in each plot and tagged for recording the various observations were also general counting of leaf at tagged plant. The number of leaf was measured at 20, 40 and At harvesting time, DAS with the help of general counting of black gram.

Fresh weight (g plant^{-1})

The number of plant counted at 20, 40 DAS and harvest stage after transplanting of crop. The number of plant were cut from me each plot and after than randomly weighting by me electronic balance.

Dry weight (g plant^{-1})

Dry weight was recorded randomly at and 60 DAS from each individual plots within a quadrate, plant enclosed within quadrate were cut down carefully closed to ground surface and then dried in room temperature (7 days). After drying these samples collected in paper bags by cutting in small pieces and was put in oven at 61 ℃ for (48hr.) drying to obtain the constant dry weight. and weighed by using electronic balance. The average dry matter value was calculated from the observation recorded in gm.

Result Discussion

The Urd bean (Vigna mungo (L.) Hipper) is commonly known as black gram. Most urd bean cultivars produce black-colored seeds. The Urd bean is a staple crop in India, Burma, Bangladesh, Pakistan, and Thailand.

The objectives of the present investigation were to bring together a comprehensive update to the research on the different nutrient management of urdbean strategies in Indian context. The solution of management practices of urdbean lies in the strategies integration of several methods including synthetic fertilizer, micronutrient and manure to increase the urdbean yield. Different nutrient management practices of urdbean to increase the growth and yield, but all synthetic caused environmental pollution, health hazards and phytotoxicity. Use of these fertilizers cannot be eliminated but can be avoided by some preventive measures including manure. These manures are non-chemicals, non-hazardous, easily bio-degradable, eco-friendly and did not have a residual effect. However, an attempt has been made to discuss the findings of present study with the help of reports available in the literature.

Therefore the present study was undertaken on effect of Si and botanicals on growth and yield of urdbean cultivation under different management practices were studies at the Department of Agriculture Sciences and Engineering, IFTM University, Moradabad. An attempt has been made to discuss the findings of present study with the help of reports available in the literature.

Table 1: Effect of silicon and botanicals on plant height (cm) of Urdbean crop

Treatments	20 DAS	40 DAS	At Harvest stage
T_1-Control	14.56	33.82	36.06
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	17.26	37.75	40.06
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	17.81	39.44	40.15
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	19.92	42.86	44.88
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	18.69	39.90	40.74
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	18.80	40.34	42.62
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	18.52	41.12	43.64
T_8—2.0 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	19.37	42.04	44.03
C.D at 5%	0.159	0.318	0.175
S.E(m)±	0.487	0.973	0.536

4.2 Number of leaves plant^{-1}

Table 2: Effect of Silicon and botanicals on Number of leaves plant^{-1}of Urd bean

Treatments	20 DAS	40 DAS	At Harvest stage
T_1-Control	3.12	7.14	1.59
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	4.46	8.87	2.11
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	4.67	9.59	2.60
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	6.26	12.62	3.19
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	4.75	11.14	2.79
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	4.84	11.38	3.09
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	5.34	11.97	3.00
T_8—2.0 ml silicon + 2 foliar spray of *Terminalia arjuna* (@ 10%	5.86	12.26	2.95
C.D at 5%	0.189	0.100	0.189
S.E(m)±	0.578	0.306	0.578

Table 3: Effect of Silicon and botanicals on Number of leaf area (cm) of Urd bean

Treatments	20 DAS	40 DAS	At Harvest stage
T_1-Control	105.3	262.5	325.2
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	108.6	314.0	350.9
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	150.2	513.6	706.7
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	204.1	1169.6	3208.2
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	83.1	385.3	836.3
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	132.8	466.8	814.3
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	128.7	545.0	771.8
T_8—2.0 ml silicon + 2 foliar spray of *Terminalia arjuna* (@ 10%	191.8	740.6	1185.4
C.D at 5%	28.900	404.617	NS
SE(m)±	9.436	132.117	634.730

Table 4: Effect of Silicon and botanicals on Number of Branches Plant^{-1} 40 Das at harvesting Time, of Urd bean.

Treatment	40 DAS	Harvesting stage
T_1-Control	1.13	2.58
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	2.20	3.30
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	1.80	3.67
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	3.93	4.20
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	2.63	3.37
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	2.83	3.43
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	3.27	3.57
T_8—2.0 ml silicon + 2 foliar spray of *Terminalia arjuna* (@ 10%	3.50	3.70
S.Em±	0.179	0.154
CD at 5%	0.548	0.472

Table 5: 50% flowering Effect of Silicon and botanicals on Number of Urd bean

Treatments	50% flowering
T_1-Control	35.0
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	39.3
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	40.7
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	43.7
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	39.3
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	40.3
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	42.3
T_8—2.0 ml silicon + 2 foliar sprayof *Terminalia arjuna* (@ 10%	43.0
S.Em±	0.697
CD at 5%	2.135

Table 6: Effect of Silicon and botanicals on number of pods/ plant; of Urd bean

Treatments	Pod plant^{-1}
T_1-Control	12.88
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	17.91
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	18.42
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	19.92
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	17.35
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	17.46
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	18.83
T_8—2.0 ml silicon + 2 foliar spray of *Terminalia arjuna* (@ 10%	18.87
S.Em±	0.259
CD at 5%	0.793

Table 7: Effect of Silicon and botanicals on pods length (cm) of Urd bean

Treatments	At harvesting time
T_1-Control	2.93
T_2-1.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	3.43
T_3- 1.5 ml silicon + 2 foliar spray of *Tinospora cardio folia* @ 10%	3.53
T_4-2.0 ml silicon + 2 foliar spray of *Tinospora cardio folia* @10%	4.27
T_5-0.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @ 10%	3.43
T_6—1.0 ml silicon + + 2 foliar spray of *Terminalia arjuna* @ 10%	3.50
T_7--1.5 ml silicon + 2 foliar spray of *Terminalia arjuna* @10%	3.63
T_8—2.0 ml silicon + 2 foliar spray of *Terminalia arjuna* (@ 10%	3.80
S.Em±	0.177
CD at 5%	0.542

Conclusion

The experiment consisted individual doses of Phosphorus and three Iron spray at different stages the integrated dose of Phosphorus and Iron spray tested in experiment for study in Randomized Block Design with 3 replication, the summary of experiment results accessed stated below.

- The highest plant height at 20 and 40 DAS was recorded from the T_4)
- The highest value of fresh and dry weight at 30 and 60das were reported in the T_7 (Phosphorus 60 kg/ha +Iron (FS)
- The maximum number of branches per plant, number of pod per plant, number of grain per plant 1000 seed weight, was observed from the T_7 (Phosphorus 60 kg/ha +Iron (FS)
- A maximum value of number of root nodule at 30 DAS was counted from the plant taken from the T_7 (Phosphorus 60 kg/ha +Iron (FS)
- The highest biological yield, Grain yield and straw yield Q/ha and HI % was recorded from the T_7 (Phosphorus 60 kg/ha +Iron (FS)
- T_7 (Phosphorus 60 kg/ha +Iron (FS)was economical and maximum gross income net income and benefit cost ratio was work out.

Considering the above summaries the following conclusion can be drawn

- The growth character *viz* Plant height, dry and fresh weight, number of nodule per plant is maximum when black gram was fertilized with 60 kg phosphorus along with three Iron spray.
- Better quantity yield attributes like no of branches branches per plant, number of pod per plant, number of grain per plant 1000 seed weight, can be observed by the utilization same treatments.
- For harvesting maximum amount of grain and profit the farmer can use the 60 kg phosphorus along with three Iron spray.

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