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# EFFECT OF MICROCLIMATIC CONDITION ON GROWTH AND YIELD OF BLACK GRAM (*VIGNAMUNGO*L.) IN ALLAHABAD CITY, INDIA

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**Abstract**

The present investigation was conducted at Sam Higginbottom Institute of Agriculture, Technology and Sciences (Formerly: Allahabad Agricultural Institute) Deemed-to-be-University, Allahabad (U.P), during the year of 2014-2015with the objectives effect of microclimatic condition on growth and yield of black gram (*Vignamungo*L.) in Allahabad. The experiment consists of nine treatment combination laid out in factorial randomizations block design with three replications. The important finding of present investigation is given below. The character studied where germination percentage, plant height, day taken to 50% flowering, number of cluster per plant, number of pod per plant, test weight, grain yield and some meteorological characters viz. GDD, PTU, HTU phenophase stages. We observed that the effect of variety where significant with all characters, the effect of 23 july DAS, 30 july DAS and 06 august where significant with plant height, test weight and grain yield and non-significant with germination, day taken to 50% flowering, number of cluster, number of pod and interaction (V×D) effect where significant with plant height, day taken to50% flowering and number of cluster and grain yield and non-significant germination percentage, number of pod and test weight. From this study it is concluded that the black gram variety Narendra-55 found to be most suitable for sowing at 06 august and it performed better grain yield and yield component parameters.

**Keyword:- Black gram, sowing date, meteorological parameter**

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## INTRODUCTION

Black gram belongs to the family fabaceae and the genus *Vigna*. It is a staple crop in the central and South East Asia, however it is extensively used only in India and now grown in the Southern United States, West Indies, Japan and other tropics and subtropics (**Biswas *et al.*, 2002**).

Black gram is one of the most highly prized pulse crop, cultivated in almost all parts of India. It has inevitably marked itself as the most popular pulse and can be most appropriately referred to as the "king of the pulses" due to its mouth watering taste and numerous other nutritional qualities. Whether it be the very special "Dal Makhni" of Punjab or the "Vada Sambhar" of South India, the taste rules the hearts of one and all alike. Indian immigrants have popularized the taste worldwide as well. (**Ahmad *et al.*2005).**It stands next to soybean in its dietary protein content. It is rich in vitamin A, B1, B3 and has small amount of thiamine, riboflavin, niacin and vitamin C in it. It contains 78% to 80% nitrogen in the form of albumin and globulin. (**Gupta *et al.*, 2007**).

Being a proper leguminous crop, it is itself a mini-fertilizer factory, as it has unique characteristics of maintaining and restoring soil fertility through fixing atmospheric nitrogen in symbiotic association with Rhizobium bacteria, present in the root nodules **(Jindal *et al.* 2011).**

India is the largest producer as well as consumer of black gram. Black gram occupies unique position in Indian agriculture. Among the pulses, it stands fourth in production and acreage (**Pandey *et al.*2011**).

In India, It accounts for 70% of the world production and its output accounts for about 10 per cent of India's total pulse production. It ranks third among all pulses grown in India after chickpea and pigeon pea. India is the largest producer as well as consumer of black gram. Black gram is also grown on marginal lands under rained conditions and thus results in lower productivity. There is no much improvement in the development of new varieties in black gram and there is a need to give more emphasis on the improvement in plant characteristics associated with yield potential and also the possibility of increasing yield potential through the use of nutrients. **(Kannapiranl *et al.*, 2011).**

## MATERIALS AND METHODS

A field experiment was conducted at the Research Farm of Department of Environmental Science, School of Forestry & Environment, Sam Higginbottom Institute of Agriculture**,** Technology & Sciences (Deemed-to-be-University) Allahabad, (U.P.) India. The area is situated on the south of Allahabad on the right sight of river Yamuna and geographically positioned at 25°24′46.14″ N latitude 81°50′49.95″E longitude and at the altitude of 98 meters above the mean sea level. The mean temperature during the growth period was 5.9° to 33.3 C. The soil of experimental area falls in order of Inception and experimental field is alluvial in nature. The data was statistically analyzed with 3x3 factorial randomized block design having two factors with five date of sowing such as $D_1$(23 July., 2014), $D_2$(30 July., 2014), $D_3$(6 August, 2014), and three varieties of black gram such as Pant uard-35,Narendar-55andPUSA -1.Treatment combinations were

$T_1(D_1V_1)$,$T_2(D_1V_2)$,$T_3(D_1V_3)$,$T_4(D_2V_1)$,$T_5(D_2V_2)$,$T_6(D_2V_3)$,$T_7(D_3V_1)$,$T_8(D_3V_2)$,$T_9(D_3V_3)$and the treatments was replicated thrice. Basal dose of fertilizer was applied in respective plots according to treatment allocation in unifurrows opened about 5 cm. depths before sowing seeds in soil, at the same time seeds was shown on well prepared beds in shallow furrows, at the depth of 2.5-3cm. row to row distance 30cm and plant to plant 15cmwas maintained. The percent Germination of seeds per plot, Plant height (cm), Number of branches per plant, Days taken to flowering 50**%**, Number of cluster per plants, Number of pods per plant, Test weight (1000 seeds)and Grain yield (q/ha)seeds were recorded during the experiment. The observations were recorded as mean values of the data.

## RESULTS AND DISCUSSIONS

### Percent germination of seeds and Plant height (cm)

Observations on the germination percentage. Performance under different varieties from perusal of data in growth stages showed germination percentage significant difference from perusal of data was observed that there was a steady showed non-significant difference on germination percentage.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different date of sowing and varieties observed non-significant difference on germination percentage.

Different date of sowing and varieties did not affect the germination at early stages of growth. This may have been due to the late sowing but (90%) in $T_8(D_3V_2)$ at later stages the germination percentage is maximum was may be due to the more suitable and (75%)$T_4(D_3V_1)$ is minimum germination% environment conditions and availability of temperature humidity, sun-shine hours. Similar reports have been reported **Pratap *et al.*, (2010).**

Performance under different varieties from perusal of data in 25, 50 and 75 DAS growth stages plant height showed significant difference. Performance under different date of sowing from perusal of data was observed that there was a steady increase in plant height from 25 DAS to 75 DAS. Whereas 25, and 75 DAS, showed significant difference and 50 DAS showed non-significant difference on plant height.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different date of sowing and varieties in 25 and 75 DAS showed significant differences and 50 DAS showed non-significant difference.

Different date of sowing and varieties did not affect the plant height at early stages of growth. This may have been due to the late sowing but, at 25 days maximum plant height (19.18)and treatment combination $T_8(V_2D_3)$ and minimum plant height (15.90) and treatment combination $T_3(V_3D_1$.

At 50 days maximum plant height (34.47) and treatment combination $T_8(V_2D_3)$ minimum plant height (28.2) and treatment combination $T_1$ $(V_1D_1)$.

At 75 days maximum plant height (51.36) and treatment combination $T_8(V_2D_3)$ and minimum plant height (44.30) and treatment combination $T_1(V_1D_1)$.

At later stages the growth increase was may be due to the more suitable environment conditions and availability of temperature humidity, sun-shine hours. Similar reports have been reported by **Parmar (1983), Isha. *et al.* (2011).**

**DAY TAKEN TO FLOWERING**

Performance under different varieties from perusal of data in growth stages showed flowering percentage significant difference. Performance under different date of sowing from perusal of

data was observed that there was a steady showed significant difference on flowering percentage.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different date of sowing and varieties observed non-significant difference on flowering percentage.

Different date of sowing and varieties did not affect the flowering at early stages of growth. This may have been due to the late sowing but the maximum flowering % (35.56) was observed in treatment combination $T_8(V_2\ D_3)$where as minimum flowering % (32.20) was observed in treatment combination $T_4(V_1\ D_2)$ ).

At later stages the growth increase was may be due to the more suitable environment conditions and availability of temperature rainfall, humidity, sun-shine hours and GDD. Similar reports have been reported by**) Isha *et al.*, (2011), Rani1 *et al.*, (2014).**

**NUMBER OF CLUSTER**

Performance under different varieties from perusal of data in growth stages showed number of cluster per plant significant difference. Performance under different date of sowing from perusal of data was observed that there was a steady showed non-significant difference on number of cluster per plant.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different date of sowing and varieties observed significant difference on number of cluster per plant.

Different date of sowing and varieties did not affect the cluster at early stages of growth. This may have been due to the late sowing but, at maximum (10.53) number of clusters was observed in treatment combination $T_8(V_2\ D_3)$ whereas minimum number of cluster (7.60) was observed in treatment combination $T_6(V_3\ D_2)$ ).

At later stages the growth increase was may be due to the more suitable environment conditions and availability of temperature rainfall, humidity, sun-shine hours and GDD. Similar reports have been reported by **Biswas *et al.*, (2002).**

**NUMBER OF PODS PER PLANT**

Performance under different varieties from perusal of data in growth stages showed number of pod per plant significant difference. Performance under different date of sowing from perusal of data was observed that there was a steady showed non-significant difference on number of pod per plant.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different date of sowing and varieties observed non-significant difference on number of pod per plant.

Different date of sowing and varieties did not affect the pod at early stages of growth. This may have been due to the late sowing but the maximum number of pod(43.90) was observed in treatment combination$T_8(V_2D_3)$, whereas minimum number of pod 30.63) was observed in treatment combination $T_9(V_3D_3)$.

At later stages the growth increase was may be due to the more suitable environment conditions and availability of temperature rainfall humidity, sun-shine hours and GDD. Similar reports have been reported by **Srivastava *et at.,* (2013), Biswas *et al.,* (2002).**

**TEST WEIGHT (1000 SEEDS)**

Performance under different varieties from perusal of data in growth stages showed number of test weight of black gram significant difference. Performance under different date of sowing from perusal of data was observed that there was a steady showed significant difference on test weight of black gram.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different dates of sowing and varieties observed non-significant difference on test weight of black gram.

Different date of sowing and varieties did not affect the test weight at early stages of growth. This may have been due to the late sowing but, the maximum (1000) seeds test weight (47.16)was observed in treatment combination $T_8(V2D_3)$, whereas minimum (1000) seeds test weight (30.96) was observed in treatment combination $T_1$ $(V_1D_1)$.

At later stages the growth increase was may be due to the more suitable environment conditions and availability of temperature rain fall humidity, sun-shine hours and GDD. Similar reports have been reported by **Ghafoor *et al.*, (2005), Gupta *et al.*, (2007).**

**GRAIN YEILD (q/ha)**

Performance under different varieties from perusal of data in growth stages showed number of grain yield of black gram significant difference. Performance under different date of sowing from perusal of data was observed that there was a steady showed significant difference on grain yield of black gram.

Interaction effect between different date of sowing and varieties from perusal of data interaction effect between different date of sowing and varieties observed significant difference on grain yield of black gram.

Different date of sowing and varieties did not affect the grain yield at early stages of growth. This may have been due to the late sowing but, at maximum grain yield (11.50)was observed in treatment combination $T_8(V_2D_3)$, whereas minimum grain yield (6.31) was observed in treatment combination $T_1(V_1D_1)$.At later stages the growth increase was may be due to the more suitable environment conditions and humidity, temperature, rain fall and sun-shine hours and GDD. Similar reports have been reported by **Biswas *et al.*, (2002).**

**Table 1: Effect different varieties and dates of sowing on growth and yield of black gram (*VignamungoL.*)**

| Treatment Combination | seed germination (%) | Plant height (cm) | Days taken to 50% flowering | Number of cluster plan$^{-1}$ | Number of pod plant$^{-1}$ | Test weight (1000 seeds) | Grain yield (qha$^{1}$) | (C:B) Ratio |
|---|---|---|---|---|---|---|---|---|
| **$T_1(D_1V_1)$** | 79.33 | 44.30 | 32.36 | 7.73 | 35.66 | 30.96 | 6.313 | 1:1.20 |
| **$T_2(D_1V_2)$** | 84.00 | 47.04 | 32.73 | 8.70 | 38.30 | 37.90 | 8.263 | 1:1.60 |
| **$T_3(D_1V_3)$** | 79.00 | 45.86 | 33.03 | 8.40 | 36.81 | 36.47 | 7.983 | 1:1.60 |
| **$T_4(D_2V_1)$** | 75.66 | 46.16 | 32.20 | 8.40 | 36.43 | 34.74 | 6.610 | 1:1.35 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **$T_5(D_2V_2)$** | 85.00 | 50.60 | 33.06 | 9.10 | 38.46 | 42.50 | 8.400 | 1:1.70 |
| **$T_6(D_2V_3)$** | 78.33 | 45.86 | 33.26 | 7.60 | 30.95 | 37.14 | 7.757 | 1:1.56 |
| **$T_7(D_3V_1)$** | 75.00 | 45.96 | 32.53 | 8.41 | 36.80 | 34.52 | 6.650 | 1:1.35 |
| **$T_8(D_3V_2)$** | 90.00 | 51.36 | 35.56 | 10.53 | 43.90 | 47.16 | 11.507 | 1:1.85 |
| **$T_9(D_3V_3)$** | 83.33 | 46.23 | 33.43 | 6.96 | 30.63 | 37.52 | 6.650 | 1:1.34 |
| **F- test** | NS | S | NS | S | NS | NS | S | |
| **SED (±)** | 4.20 | 0.84 | 0.74 | 0.64 | 2.75 | 2.60 | 0.47 | |
| **C. D. at 5%** | - | 1.79 | - | 1.35 | - | - | 1.00 | |

**CROP PHENOLOGY**

The data on length of phenological stages are presented. The observation on crop phonological events reflected the influence of weather elements on crop growth and development. In the present study, the occurrence of different phenological stages viz., germination, branching, flowering, pod development, physiological maturity were recorded. The $D_1$ sowing (23 July) took highest days (85) to reach its maturity stage the $D_2$ sowing (30 July) took (82) days to reach maturity. However $D_3$(06 august) took highest days (84) to reach its maturity stage. The days to maturity was decreased gradually with the delay in sowings. This may be due to increase in temperature and photo thermal environment encountered by the crop during the growth period. This led to forced maturity of black gram crop. However, reduction in maturity duration by 16 days under $D_3$ sown condition is mainly due higher maximum temperature (39.6°C) after flowering of black gram **Rani1*et al.*, (2014)**

**Agro meteorological Indices**

Several agro-meteorological indices developed by utilizing various meteorological elements are found in literature to study the crop weather relationship **Rani1 *et al.*, (2014).** The indices such as Growing degree days (GDD), Helios-thermal unit (HTU), Photo thermal units (PTU) and Heat use efficiency (HUE) were calculated in the present study

**Table.2. Effect of different levels of nutrients and dates of sowing on Agro meteorological indices.**

| **Date of sowing** | **Levels of Agro meteorological indices (A)** | **Mean (D)** |
|---|---|---|

| (D) | PTU | GDD | HTU | |
|---|---|---|---|---|
| $D_1$(23 July, 2014) | 102.51 | 679.33 | 1019.13 | **600.32** |
| $D_2$(30 July,2014) | 102.06 | 599.72 | 1030.02 | **577.26** |
| $D_3$(06 Aug.,2014) | 102.39 | 597.8 | 1058.23 | **486.14** |

## CONCLUSION

The maximum percent germination of seeds per plot 90.00%, Plant height 47.04 cm plant$^{-1}$, 15.11, Flowering per cent 35.56%, Number of cluster per plant 10.53, number of pod plant$^{-1}$43.90, test weight 47.16 qha$^{-1}$grain yield 11.507qha$^{-1}$ were found in $T_8(V_2D_3)$ (06 August+ Nerendra-55) treatment. The maximum Net profit ₹ 22703 ha$^{-1}$ with benefit cost ratio is 1:1.85 were also recorded in $T_8(V_2D_3)$. Agro meteorological indices GDD 385.93, PTU 4086.71 and HTU 2713.47 were found in $D_3$(06 Aug., 2014).

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