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PERFORMANCE OF DIFFERENT SUMMER MUNG (*Vigna radiata* L.) VARIETIES SOWN AT DIFFERENT DATES UNDER MANIPUR VALLEY CONDITION

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ABSTRACT

The performance of five varieties of summer mung (greengram)- DGSS-4 (V1), HUM-16 (V2), HUM-2 (V3), HUM-6 (V4) and HUM-12 (V5) under three dates of sowing- 24th February (D1), 5th March (D2) and 15th March (D3) were recorded. The results indicated that sowing on D3 recorded maximum plant height (40.30 cm), number of branches plant^{-1} (4.14), dry matter accumulation plant^{-1} (14.51 g), number off nodules plant^{-1} (17.79), nodule dry weight (95.91 mg) and the variety, V1 recorded highest number of cluster plant^{-1} (6.09), pods cluster^{1} (4.14), seeds pod^{-1} (12.03) and seed yield (1083.57 kgha^{-1}) amongst all the varieties.

INTRODUCTION

Green gram (*Vigna radiata* L.) is an important pulse crop in India and being cultivated in rainfed tract (Chhodavadia *et al.*, 2014). Its seed is more palatable, nutritive, digestible and non-flatulent than other pulses grown in country (Tyagi *et al.*, 2014). Summer mungbean is hardiest of all the pulse crops and can tolerate high temperature exceeding 40ºC and grown well in the temperature range of 30-35ºC. It has wider adaptability and low input requirements and the ability to fix nitrogen in symbiotic association with rhizobia (58-109 kgha^{-1}), which not only enables it to meet its own requirement but also benefits the succeeding crops . This crop is fitted well in multi-cropping systems because of its rapid growth, less water requirement and early maturity and results in the increase of small landholders' income and improvement of soil fertility.

Mungbean is well adapted in Manipur due to its congenial agro-climatic condition. However, since it is not a prioritized crop in kharif season, farmers usually do not cultivate as rice occupy all the land and the economic value is less known and recognized. Hence research is mandatory for incorporating short duration varieties of mungbean in summer prior to rice cultivation. This would not only fetch income to the farming communities, but enrich the soil for the succeeding rice crop. The period from later part of November after rice harvest to early part of June remains fallow which can be successfully utilized for cultivation of short duration legumes like mungbean as the research on summer mungbean in Manipur is not yet reported earlier. Meeting the requisite crop diversification in the state, improving soil health, income generation and socio-economic development of the farming communities are the major benefits of mungbean research in the state.

One of the major requirements in crop planning is to determine the best planting time. It is an important factor that influence vegetative and reproductive growth period. It also affects other production factors, harvest, quality and ultimately crop yield and quality. Timely sowing of this crop is of paramount importance to obtain the best out of the varieties. Any delay in sowing not only reduces the yield but creates problem for harvesting of the same if caught by pre-monsoon showers. Optimum date of sowing of mungbean may vary from variety to variety and season to season due to variation in agro-ecological conditions. Therefore, there must be specific date of sowing for different varieties to obtain maximum yield. Keeping the above in view the present was undertaken with the objectives of selecting the most suitable variety to sow in the most suitable sowing time under valley condition of Manipur.

MATERIALS AND METHODS

The experiment was conducted at the experimental field of College of Agriculture, Central Agricultural University, Imphal during the summer season of 2016 and laid out in factorial randomized block design with three replications. The soil of the experimental field was studied by the Bouyoucos Hydrometer method (Bouyoucos, 1962) and recorded clayey. It had a pH of 5.4 which was determined by the glass electrode pH meter (Jackson, 1973). The organic carbon content was determined by Walkley and Black rapid titration method (Walkley and Black, 1934) and was reported to be high (1.07%). Available nitrogen (301.0 kgha^{-1}), phosphorous (20.23 kgha^{-1}) and potassium (314.50 kgha^{-1}) were all recorded to be in the medium range and they were determined by the Alkaline

permanganate method (Subbiah and Asija, 1956), Bray and Kurtz method (Jackson, 1973) and Flame Photometer method (Jackson, 1973) respectively.

The meteorological observations were collected from the Experimental Agromet Advisory Service, ICAR Complex for NEH Region, Manipur Centre, Lamphelphet, Imphal. The mean minimum and maximum temperature recorded during the cropping season was 15.5 and 27.5ºC, respectively. The total rainfall recorded was 22.8 mm. The average relative humidity in the morning hours was 88.0% and in the evening 58.1%. The average bright sunshine hours ranged was 5.9 and wind speed recorded 5.4 km hr^{-1}.

The experiment was laid out in factorial randomized block design and replicated thrice consisting of 15 treatments *viz.*, 24th Feb + DGGS-4 (T1), 24th Feb + HUM-16 (T2), 24th Feb + HUM-2 (T3), 24th Feb + HUM-6 (T4), 24th Feb + HUM-12 (T5), 5th March + DGGS-4 (T6), 5th March + HUM-16 (T7), 5th March + HUM-2 (T8), 5th March + HUM-6 (T9), 5th March + HUM-12 (T10), 15th March + DGGS-4 (T11), 15th March + HUM-16 (T12), 15th March + HUM-2 (T13), 15th March + HUM-6 (T14) and 15th March + HUM-12 (T^{15}) respectively. Recommended dose of N, P and K (20: 40: 40 Kg N, P_2O_5 and K_2O kg ha^{-1}) was applied in the form of Urea, SSP and MOP respectively. The entire quantity of fertilizer was applied at the time of sowing to all the plots equally. Bold and healthy seeds were selected. Twenty days after sowing, the seedlings were thinned to maintain only two plants per spot in order to maintain the desired plant population. During the experimental period to prevent pest and disease incidence suitable insecticide Imidacloprid was sprayed at 20-25 days for controlling stem fly and thrips. To keep the entire plots weed free during the crop growth period Pendimethalin at 0.1 kg a.i. per hectare as pre emergence spray followed by two hands weeding at 30 and 45 days after sowing were carried out for all the plots to keep the experimental site clean and reduce the crop weed competition. Drainage was done during the heavy rains as and when required, to avoid water stagnation in the field.

RESULTS AND DISCUSSION

Plant height

Plants were tallest when sown on D3 (40.30 cm) and D1 reported shorter plants (38.3cm). Plant height increased gradually with delay in sowing due to increased temperature and sunshine hour. This resulted in better growth parameters of the crop plants. Shorter plant height was obtained from V3 (38.05 cm) and tallest in V1 (40.31 cm). This variation in plant height might be attributed to the genetic characters. The results are in close conformity with the findings of Miah *et al*. (2009) and Parvez *et al*. (2013).

Number of branches

Number of branches per plant, were higher in D3 (4.14) and minimum in D1 (3.66). The number of branches increases with delay in sowing due to favourable environmental conditions which helped in luxuriant growth of the plants. The number of branches was highest in V1 (4.35) and lowest in V3 (4.22). The differences among the mungbean genotypes with respect to branches formation may be owing to inheritance of genetic divergence of the genotypes. The results of present investigation corroborate with the findings of Bhowmick et al. (2008) and Verma *et al*. (2011).

Plant dry matter accumulation

Highest dry matter accumulation (DMA) per plant was recorded in D3 (14.51 g) and minimum in D1 (11.95 g). The increase in DMA might be due to increase in temperature which increase the photosynthetic rates until photosystem destruction begin. Maximum plant DMA (13.70 g) was recorded from the variety V1 . This increase might be due to increase in morphological parameters which are responsible for the photosynthetic capacity of the plant. Similar observations were also recorded by Goswami *et al*. (2010) and Gorade *et al*. (2014).

Number of nodules per plant

As compared to all dates of sowing the number of nodules per plant was highest (17.79) in D3. This might be due to better photosynthesis and partition to assimilate to nodules. The similar increased in number of nodules were also confirmed by Ram and Dixit (2000) and Singh and Singh (2009). The highest nodule number was observed in the variety V2 (17.41).

Nodules dry weight (mg)

The nodules dry weight per plant was recorded maximum when sown on D3 (95.91 mg) and minimum (84.29 mg) when sown on D1. The nodules dry weight increases with delayed in sowing due to better photosynthesis and partition to assimilate to nodules. The similar increased in number of nodules were also confirmed by Chovatia *et al*. (1993) and Singh *et al*. (2008). The highest nodule dry weight was observed in the variety V2 (93.39 mg) and lowest in V3 with 88.41 mg. This increase in nodule dry weight might be due to the favourable weather condition, sunshine hours and sufficient moisture content in the soil.

Number of cluster plant^{-1}

Significantly maximum number of cluster per plant (5.87) was observed from D1 and minimum was recorded from D1 (5.10). The increase in number of cluster plant^{-1} might be due to higher dry matter production which could be due to better weather condition which resulted in greater translocation of food materials to the reproductive parts. Highest number of cluster plant^{-1} was recorded from DGGS-4 variety (6.09) and

Table 1: Effect of dates of sowing and varieties on the growth and yield of greengram

Treatment	Plant height (cm)	Branch /plant	DMA (gm/plant)	Nodule /plant	Nodule dry weight (mg)	Cluster /plant	Pods / cluster	Seeds / pod	Yield (kg/ha)
Dates of sowing									
D1	38.39	3.66	11.95	15.81	84.29	5.10	3.47	11.28	972.91
D2	38.87	3.95	13.30	16.97	92.56	5.49	3.86	11.58	1049.78
D3	40.30	4.14	14.51	17.79	95.91	5.87	4.10	11.71	1081.55
S.E(d) (±)	0.42	0.08	0.21	0.48	2.00	0.15	0.14	0.14	22.58
CD (0.05)	0.86	0.16	0.43	0.98	4.10	0.31	0.29	0.29	46.24
Varieties									
V1	40.31	4.35	13.70	17.02	91.27	6.09	4.14	12.03	1083.57
V2	38.95	4.29	13.59	17.41	93.38	5.04	3.70	10.79	1059.95
V3	38.05	4.22	12.76	16.57	88.41	5.27	3.60	11.41	988.84
V4	38.73	4.23	12.94	16.40	89.32	5.55	3.72	11.52	1003.23
V5	39.89	4.27	13.32	16.90	91.77	5.15	3.89	11.86	1038.14
S.E(d) (±)	0.54	0.11	0.27	0.62	2.59	0.20	0.18	0.18	29.15
CD (0.05)	1.10	0.23	0.55	NS	NS	0.41	0.37	0.37	59.70
Dates of sowing and varieties interaction									
T1 (D1 V1)	38.90	3.90	12.61	16.83	88.95	5.84	3.89	12.03	1015.42
T2 (D1 V2)	37.07	3.80	12.44	15.9	86.25	5.22	3.53	10.43	994.02
T3 (D1 V3)	37.54	3.54	11.52	14.65	77.80	4.62	3.09	10.87	949.22
T4 (D1 V4)	37.89	3.51	11.23	15.69	85.54	4.88	3.27	11.33	910.72
T5 (D1 V5)	40.54	3.57	11.98	16.00	82.90	4.94	3.56	11.73	995.14
T6 (D2 V1)	40.29	4.10	13.17	16.36	89.68	5.89	4.19	11.83	1089.55
T7 (D2 V2)	39.22	4.02	14.20	18.19	95.75	5.36	3.66	10.87	1066.68
T8 (D2 V3)	38.13	3.77	12.89	17.39	94.33	5.35	3.79	11.70	1004.29
T9 (D2 V4)	37.23	3.92	13.46	16.24	89.38	5.81	3.80	11.60	1045.37
T10 (D2 V5)	39.48	3.95	12.78	16.67	93.66	5.06	3.88	11.90	1043.00
T11 (D3 V1)	41.74	4.29	15.33	17.86	96.51	6.55	4.34	12.23	1145.74
T12 (D3 V2)	40.56	4.18	14.12	18.14	98.13	5.61	3.91	11.07	1119.16
T13 (D3 V3)	38.49	3.96	13.88	17.69	93.09	5.82	3.92	11.67	1012.99
T14 (D3 V4)	41.06	4.14	14.06	17.25	93.05	5.95	4.09	11.63	1053.59
T15 (D3 V5)	39.65	4.12	15.19	18.03	98.77	5.45	4.24	11.96	1076.27
S.E(d) (±)	0.93	0.19	0.48	1.08	4.48	0.34	0.30	0.32	50.48
CD (0.05)	1.90	NS	0.98	NS	NS	NS	NS	NS	NS

HUM-16 (5.04) variety; this might be due to its genetic characteristics in the variety. Similar findings are also reported by Malik *et al*. (1981) and Rabbani *et al*. (2013).

Number of pods cluster^{-1}

The maximum number of pods per cluster was obtained from D3 (4.10), followed by 5th March and minimum (3.09) when sown on D1 . The increase in number of pods per cluster may be attributed due to higher temperature which results in profuse flowering and ultimately higher pod set. Among all the varieties V1(4.14) recorded the highest number of pods per cluster and V3 (3.60) recorded lowest. This may be due to genetic makeup of different mungbean varieties. The results are in accordance with the findings of Soomro (2003) and Begum *et al*. (2009).

Number of seeds pod^{-1}

Higher number of seeds per pod was recorded significantly from D3 sowing date. The increase in number of seeds per pod was due to higher dry matter production which resulted in greater translocation of food materials to the reproductive parts. Higher number of seeds per pod was recorded from DGGS-4 variety (12.03). While, significantly lower number of seeds per pod (10.79) was recorded from HUM-16 variety. This might be due to genotypic difference in the varieties. Similar findings are also reported by Bhowaland and Bhowmik (2014) and Vakeswaran *et al*. (2016).

Seed yield (kg ha^{-1})

The highest seed yield of 1081.55 kg ha^{-1} was obtained from D3 while the lowest seed yield (972.91 kg ha^{-1}) was observed from D1 . The lower grain yield of mungbean in early planting might be due to lower temperature at early stages of crop growth. The increase in seed/grain yield in 15th March might be due to suitable temperature prevailing accompanied by the higher soil moisture content due to sufficient rainfall, which enhanced the vegetative as well as the reproductive growth of the crop. Higher seed yield of 1083.57 kg ha^{-1} was obtained from DGGS-4 variety and lowest seed yield of 988.84 kg ha^{-1} was obtained from HUM-2 variety. The difference in seed yield among genotypes may be due to differential behaviour of genotypes. The probable reason of this difference might be due to higher number of pod length, seeds per pod. Genotypic variation in seed yield was also observed by Patil *et al*. (2003) and Kumar *et al*. (2009).

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