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Herbicidal effect of Propaquizafop, imazethapyr and pendimethalin on seed quality parameters of black gram (*Vigna mungo* L.)

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Abstract

A field experiment was conducted at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during kharif 2014-15 to assess the effect of different herbicides on seed quality parameters of black gram (*Vigna mungo* L.). The experiment was laid out in randomized block design (RBD) with three replications and nine treatments included different herbicides i.e. Propaquizafop, Imazethapyr and Pendimethalin in different concentration which significantly affected the biochemical parameters, physiological parameters, growth determinants and yield attributing traits.

It was concluded that post emergence herbicide application as combination of propaquizafop+ imazethapyr (56+85 to 53+80 g/ha) was found more effective to control weeds after the hand weeding in black gram.

Keywords: Propaquizafop, imazethapyr, pendimethalin

Introduction

Black gram (*Vigna mungo* L.) belongs to family fabaceae is one of the important *kharif* pulse crops grown in tropical and sub-tropical climate and throughout the India, next to green gram. It is sown with the onset of rainy season. Simultaneous emergence and rapid growth of weed competition for light, moisture, space and nutrients. It has an ideal temperature range between 25 C to 30 C. It is consumed in the form of 'dal' (whole or split, husked or un-husked).

In India black gram cultivated on 3.11 million hectare area with total production of 1.90 million tonnes and average productivity of 642 kg/ha. (Anonymous, 2012) [2]. In Madhya Pradesh it is one of the leading pulses crop and occupied area of 0.59 million hectares, with the production and productivity of 0.21 million tonnes and 374 kg/hectares.

Among the several factors limiting the crop yields, weeds by their manifold harmful effects, rank as prime enemies. Weeds compete with crop in initial stages for limited essential resources and seriously depress the crop growth and development. Imazethapyr 10% SL is the herbicide of the Imidazolinone group used for selective broadleaf and grass weeds control in crop. It is a systemic herbicide that is rapidly absorbed by the roots and the leaves and translocated to the apical meristem. Propaquizafop 10% EC is a herbicide of the Arylophenoxy propionates family. It is a systemic herbicide.

Among the herbicide treatments, application with Pendimethalin has recorded significant increase in total dry matter content followed by Imazethapyr as compared to control. Significantly lower TDM was observed in control at all the stages. (Amare gouda *et al.*, 2013). Application of Imazethapyr + Quisqualop treatments providing favourable environment for crop with controlling weeds, which reduces the competition of crop with weeds for space, air, sunlight, moisture and nutrients. Significantly higher number of pods and seed weight per plant. (Prachand *et al.*, 2014) [7].

Black gram is an important pulse crop in India. It is a chief constituent of delicious food. In the south, the husked dal paste and with equal quantity of rice flour to make 'dosa' and 'idli'. It contains 48.0% carbohydrates, 22.3% protein, 154 mg calcium, 9.1 mg iron, 1.4 g fat, 0.37 g riboflavin and 0.42 mg thiamin in per 100 gm of blackgram (Asaduzzaman *et al.*, 2010) [3]. These contain a high percentage of quality protein nearly three times as much as cereals (Upadhyay *et al.*, 1999) [8]. Thus, they are a cheaper source to overcome protein malnutrition among human beings.

For vegetarian diet, pulses form the major source of protein. In fact, lysine is the most limiting essential amino acid in cereals which is very well supplemented by the protein of pulses. The pulses are known to improve the physical characteristics of soil through tap root system which opens the soil into the deeper strata and their ability to use atmospheric nitrogen through

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biological nitrogen fixation which is economically sound and environmentally acceptable.

In addition, they also provide nutritious fodder and feed for livestock. Pulses are drought resistant and prevent soil erosion due to their deep root and good ground cover, because of these good characters, pulses is called as "Marvel of Nature".

Material and Methods

Biochemical parameters

The plant parts were analyzed for the biochemical constituents at different crop growth stages as follows:-

Table 1: Biochemical estimation of different pant part:

S. No	Biochemical contents	Plant part	Stages
1.	Ash Protein & nitrogen	Seed	Maturity
2.	Carbohydrate	Seed	Maturity
3.	Fat	Seed	Maturity
4.	Fiber	Seed	Maturity
5.	Ash	Seed	Maturity

Estimation of protein and nitrogen in seed: The nitrogen content was estimated by micro kjeldhal method (AOAC, 1965). Nitrogen and protein percent were calculated by the following formula:

$$\text{Nitrogen} = \frac{14 \times \text{Normality of H}_2\text{SO}_4 \times \text{Vol. of H}_2\text{SO}_4 \times 100}{\text{Weight of sample} \times 100}$$

Protein percent in the sample was estimated multiplying nitrogen percent of sample by factor 6.25., Protein (%) = Nitrogen % x 6.25

Estimation of total carbohydrates percentage: Total carbohydrates in the sample were estimated by the hydrolysis method as described -

Reagents: 5% phenol (Dissolve 50g of redistilled (reagent grade) phenol in water and dilute to one liter), 96% sulphuric acid (reagent grade), glucose: stock - 100mg in 1(x) ml of water, working Standard 10ml of stock solution diluted to 100ml with distilled water.

Determination of fat percentage: The fat content in the sample was estimated by Palican Equipment Socs Plus based on principle of soxhlet's extraction method as described in AOAC (1980)^[4].

$$\text{Fat \% in ground sample} = \frac{\text{Wt. of flask (B)} - \text{wt of flask (A)}}{\text{Wt. of sample}} \times 100$$

Estimation of Seed Crude fiber (%): This is the product of seed crude fiber was calculated by the following:

$$\text{Seed Crude fiber (\%)} = \frac{\text{Weight of silica crucible with content before ashing} - \text{X weight of silica crucible with content after ashing}}{\text{Sample weight}}$$

Estimation of total ash: The ash content in the sample was estimated according to AOAC method (1980)^[4].

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Result

Biochemical Estimations

The seed carbohydrate content (%) (Table 2) was significant variability due to black gram treatments under the effect of different herbicide (Table 2). Investigation reported higher rate of carbohydrate present under T₈ hand-weeding (48.36) treatment and minimum was found under T₉ weedy-check (31.99). It is correlated with protein, fat, fibre, ash and moisture content of seed.

The results of estimation of protein (Table 2) indicated that treatment T₈ hand weeded plot (37.23) and T₄ propaquizafop + imazethapyr (53 +80 g/ha) (36.24) possessed significantly more protein content over rest of the treatments. In sixteen mung bean varieties were studied for their proximate composition and protein isolates' properties. A wide range of variation was observed: crude protein content ranged 24.26-28.50, similar results were reported by Li *et al.* (2010) while the lowest protein content (%) was estimated in weedy check plot T₉ (31.46).

The seed fat content (%) varied significantly due to various treatments under the effect of different herbicide on different crop growth stages (Table 2) maximum fat (%) was noted in hand weeded plot T₈ (0.162) at par with T₄ (0.155), while weedy check plot T₉ (0.051) had the lowest value as compared to all others. Maximum rate of fat was registered under T₈ treatment (0.162) was observed in 100%.

The seed fiber differed significantly due to various treatments under the effect of different herbicide at different crop growth stages (Table 2). Significantly highest seed fiber yield was noted in hand weeded plot T₈ (0.16) at par with T₄ (0.15), whereas least, seed fiber noted in weedy check plot T₉ (0.06). A wide range of variation was observed for crude fiber 3.21-4.18%, the fiber content is associated with laxative value similarly findings were also reported by Li *et al.* (2001) whereas least, seed fiber noted in weedy check plot T₉ (0.6).

Seed ash (%) varied significantly due to the treatments under the effect of different herbicide at all the different crop growth stages (Table 2) The present investigation showed that T₈ (0.09) and T₄ (0.08) weedicide treatment were associated with the maximum ash content which revealed the higher magnitude of mineral content possessed by these treatments. The minimum ash content was registered under T₉ (0.03) treatment while minimum seed oil yield was observed in weedy check plot T₉ (0.031).

Table 2: Effect of different herbicides on the seed quality parameters in black gram.

Treatment	Seed Protein (%)	Carbohydrate Content (%)	Fat (%)	Fiber (%)	Ash (%)
T1	33.16	38.98	0.073	0.07	0.058
T2	32.34	39.41	0.085	0.10	0.061
T3	35.71	42.53	0.140	0.14	0.075
T4	36.25	45.49	0.155	0.15	0.085
T5	35.25	34.24	0.093	0.06	0.060
T6	32.02	33.52	0.137	0.08	0.053
T7	34.46	35.67	0.121	0.07	0.050
T8	37.23	48.36	0.162	0.16	0.093
T9	31.46	31.99	0.051	0.06	0.031
SEm±	0.45	0.044	0.006	0.01	0.005
CD at 5%	1.36	0.134	0.019	0.04	0.016

Discussion

The treatments differed significantly among them for various biochemical traits. Crude protein content ranged 24.26-28.50

(Li *et al.* 2001). The results indicated that (Table 2) treatment T8 has more protein content in over rest of the treatments and T3 (18.49) was associated with the lowest protein content. The significantly highest Carbohydrate Content (%) and Fat (%) were found in T8 treatment (Hand Weeded) (48.36) and (0.162) and lowest were in T9 (31.99), (0.051)

The higher crude fiber was found in T8 treatment (0.16) with lower value in T9 (0.06) plot. A wide range of variation was observed: crude fibre 3.21-4.18%, the fiber content is associated with laxative value (Li *et al.* 2001).

Hormonally the plant and other samples are being ash to determine the inorganic nutrient from the sample for which the samples are heated to a temperature of around 700 °C in a muffle furnace. The study showed (Table 2) that T9 (0.16) was associated with the maximum ash content.

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