International Journal of Agricultural Sciences ☞ DOI:10.15740/HAS/IJAS/17-AAEBSSD/105-109
Volume 17 | AAEBSSD | 2021 | 105-109 ■ ISSN : 0973-130X Visit us : www.researchjournal.co.in

RESEARCH PAPER

Bio-energetics of black gram *(Phaseolus mungo)* as influenced by different weed control practices

K. D. Rajput*, J. P. Bholane, A.S. Latkar **and** V.M. Bhale
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) India
(Email: rajput.kavi13@rediffmail.com)

Abstract : A field investigation was carried out during *kharif* season in 2010 at Agronomy Department Farm,Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to evaluate the energy inputs, energy output, net energy gain and output input ratio of different weed control practices in black gram. It is observed that in herbicidal treatments, pre-emergence application of pendimethalin @ 1.5 kg/ha followed by cultural treatment of two hand weedings at 15 and 30 days after sowing recorded more energy inputs, while weedy check treatment incurred minimum energy input among all the treatments. Whereas, weed free treatment computed maximum energy output and energy balance followed by pre-emergence application of pendimethalin @ 1.5 kg/ha treatment. Similarly weed free and post emergence application (15 DAS) of fenoxyprop-p-ethyl @ 0.125 kg/ha were resulted in higher energy balance per unit input and output-input ratio than weedy check treatment.

Key Words : Herbicides, Cultural method, Weed parameters ,WCE, Yield, Energy parameters

View Point Article : Rajput, K.D., Bholane, J.P., Latkar, A.S. and Bhale, V.M.(2021). Bio-energetics of black gram *(Phaseolus mungo)* as influenced by different weed control practices. *Internat. J. agric. Sci.*, **17** (AAEBSSD) : 105-109, **DOI:10.15740/HAS/IJAS/17-AAEBSSD/105-109.**

Article History : Received : 13.07.2021; **Revised :** 16.07.2021; **Accepted :** 20.07.2021

INTRODUCTION

The weeds pose a serious problem in the cultivation of pulses. Their severity is aggravated during *kharif* season as high temperature with adequate moisture in this part of the year provide favourable conditions for their growth. Among various pulses grown during this season,the slow growing and dwarf types such as urd (Black gram) and mung (Green gram) suffers badly. In these pulses, if weeds are not checked during the first 3-4 weeks after the sowing, they pick up rapid growth and take over the crop. Therefore , for having a good crop initial checking of the weeds is most important so as to avoid yield loss . Crop productivity is a dependant function of energy inputs. Energetics approach in crop production has been comparatively recent. The two major constraints being faced by the developing countries and the third world are energy and food. The introduction of high yielding varieties, weed control practices, multiple cropping systems, use of fertilizers and mechanized agriculture has substantially alleviated the food constraints. These new technologies, however have further accentuated the energy constraints.

Energetics approach in cropping system gathered momentum through seventies due to decreasing global fossil fuel sources and rapidly increasing demand

* **Author for correspondence :**

for food. This study solely focuses on acceleration the pace of crop production on one hand and efficient energy utilization particularly for different weed control practices on other hand. Since the information available on the energetics of different weed control treatments is meager, the present experiment was carried out to find out the most efficient and economical weed control practices and its energy budgeting in black gram.

The total energy consumed in different operations for cultivation under each treatment was computed. The energy gained from the product was estimated for estimation of energy input and output, the equivalent coefficients were use as suggested by Mittal and Dhawan (1988).

MATERIAL AND METHODS

The experiment was conducted on the Research farm of Agronomy Department, Dr.Panjabrao Deshmukh Krishi Vidyapeeth (Dr.PDKV), Akola during *Kharif* season of 2010. The soil of the experimental field was clay loam with pH 7.8, 0.55% organic carbon , 234.58 kg/ha available N , 20.86 kg/ha available P_2O_5 and 322.94 kg/ha available K_2O. The experiment was conducted in a Randomized Block Design replicated three times with thirteen treatments comprising cultural and chemical weed control methods with weed free and weedy check treatments were also included (Table 1). For calculating weedpopulation in each net plot, a quadrate of1 m x 1 m area was randomly fixed and number of weeds observed in that area was counted at 15 days interval and at harvest of the crop and then these weeds were grouped as monocot and dicot. The weeds were first air dried and then kept in an oven at 65°C till the constant dry weight was obtained for weed dry weight.

Weed control efficiency (%):

Weed control efficiency was calculated by the help of formula:

WCE= (X-Y/X)*100

where, X: Weed dry matter production in weedy plot.

Y: Weed dry matter production in treated plot.

Energy studies:

Energy input:

The energy input was worked out by using the item wise energy values for each treatment.

Energy output:

The energy output from grain and straw of black gram was workout.

Energy balance:

The energy balance was worked out by deducting the energy input from the energy output for each treatment.

Energy balance per unit input:

The energy balance per unit input was calculated as:

$$\text{Energy balance per unit input} = \frac{\text{Energy balance}}{\text{Energy input}}$$

Energy output : Input ratio:

The energy output : input ratio was estimated by dividing energy output values with input values.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Weed population and weed dry weight:

All cultural practices and herbicidal application reduced the weed population significantly compared with weedy check (Table1). In all the weed control treatments among the herbicidal practices the least population and dry weed biomass were recorded significantly in pre-emergence application of pendimethalin at two different levels i.e. @1.5 kg/ha(15.75), which was more effective in controlling the broad spectrum of annual grassy and broad leaved weeds closely followed by pendimethalin @1.0 kg/ha (19.25) than weedy check (65.44) treatment as compared to the other treatments. Pendimethalin also primarily control annul grassy and broad leaf weeds (Rao,2000). Among, cultural practices of two hand weedings at 15 and 30 days after sowing followed by hoeings at 10 and 20 days after sowing significantly recorded the lowest total weed population and dry weight of weeds than the weedy check treatment and observed the higher values of weed control efficiency as compared to the others treatments and proved the most effective in controlling the weeds and kept the weed population at reduced level through out the crop growth stages (Table1). In herbicidal treatments, pre-emergence application of pendimethalin was more effective in

controlling the weeds than other treatments and decreased in weed population was noticed with higher doses of pendimethalin. Similar observations were recorded by De *et al.* (1995), Ramnathan and chandrashekharan (1998), Rathi *et al.*(2004) and Raman *et al.* (2005).

Weed control efficiency:

Weed control efficiency denotes, the control of weeds in respective treatments shows lower weed count and better weed practices. Weed free condition recorded higher weed control efficiency (97.06) among all the weed control treatments throughout the crop growth stages. In case of chemical weed control treatments among all the weed control treatments at all the crop growth stages, result of pendimethalin as pre-emergence application gave better WCE. Similar results were reported by Ahmed *et al.* (2008) in peanut crop. Pre-emergence application of pendimethalin @1.5kg/ha (87.42) recorded higher weed control efficiency followed by pendimethalin @1 kg/ha (80.91) and fenoxyprop-p-ethylat125gha^{-1}POE (80.29) in black gram as compared to weedy check. (Malliswari *et al.*, 2008).

Increased weed control efficiency and decreased weed dry matter were noticed with higher dose of herbicides. The highest weed dry weight were recorded with weedy check treatment could be due to its effectiveness in checking the intra row weeds than the rest of the all other treatments. These results are in conformity with those reported by Panwar *et al.* (1985) and Yadav *et al.* (1985).

Grain yield :

Weed management practices significantly improved the grain yield over weedy check. Uncontrolled weeds on an average reduced black gram yield by 45%. Weed free treatment recorded significantly highest (12.67 Q/ ha) grain yield among all the treatments and weedy check treatment recorded significantly lowest (5.14 q /ha) grain yield than rest of the weed control treatments (Table 1). Similar results were recorded by Sharma *et al.* (1988). In herbicidal treatments , pre-emergence application of pendimethalin @ 1.5kg/ha recorded maximum (10.05q/ ha) yield among rest of the herbicidal treatments followed by PE application of pendimethalin @ 1.0 kg/ha recorded (9.97q/ha) grain yield and remaining herbicidal treatments bring at par with each other. This treatments controlled the weeds efficiently and thus resulted in significant increased in grain yield. Pre-emergence application of pendimethalin at 1.5 kg/ha and 1.0 kg/ha gave significantly higher seed yield of black gram as compared to weedy check, Imazethapyr, quizalofop-p-ethyl and fenoxyprop-

Table 1 : Effect of different weed control treatments on weed parameters and grain yield of black gram

Treatments	Total weed population (m^{-2}) at harvest	Weed dry weight (g/m^2) at harvest	Weed control efficiency (%) at harvest	Grain yield (q ha^{-1})
T_1 - Weed free	2.39	0.47	97.06	12.67
T_2 - Weedy check	65.44	15.98	-	5.14
T_3 - 2 Hand weeding (15 *fb* 30 DAS)	27.40	3.78	76.35	9.31
T_4 - 2 Hoeing (10 fb 20 DAS)	44.00	5.99	62.52	6.81
T_5 - Imazethapyr at 50 g/ ha PE (At sowing)	38.62	5.00	68.71	6.11
T_6 - Imazethapyr at 75 g/ ha PE (At sowing)	33.10	3.95	75.28	8.28
T_7 - Pendimethalin at 1000 g/ ha PE (At sowing)	19.25	3.05	80.91	9.97
T_8 - Pendimethalin at 1500 g/ ha PE (At sowing)	15.75	2.01	87.42	10.05
T_9- Fenoxyprop-p-ethyl at 100 g/ ha POE (15 DAS)	30.70	3.88	75.72	8.83
T_{10}- Fenoxyprop-p-ethyl at 125 g/ ha POE (15 DAS)	20.60	3.15	80.29	9.86
T_{11} - Quizalofop-p- ethyl at 50 g/ ha POE (15 DAS)	50.20	10.02	37.30	7.78
T_{12} - Quizalofop-p- ethyl at 75 g/ ha POE (15 DAS)	35.55	4.95	69.02	8.55
T_{13} - Imazethapyr at 50 g/ ha PE fb Quizalofop-p- ethyl at 50 g/ ha POE (At sowing fb 15 DAS)	47.00	8.80	44.93	8.22
SE(m) ±	2.31	0.45	-	0.86
C.D.at 5% -	6.75	1.32	-	2.52
G.M. -	33.08	5.46	65.81	8.58

p-ethyl. Above results are in accordance with the findings of Malliswari *et al.* (2008) and Mishra and Bhanu (2006). Pre-emergence application of pendimethalin was selective and effective in controlling weeds and in increasing the seed yield of black gram. Similar above results in accordance with findings of Ali Mohammed and Durai (1987).

Energy input:

Total energy input, in general , was enhanced with the increase in practices of crop and its intensity. More over, the magnitude of quantitative enhancement in energy output varied with the nature of the crops in the system.

Total energy inputs were found higher in herbicidal treatments i.e. pre-emergence application of pendimethalin @ 1.5 kg/ha (4713.94 MJ /ha) followed by cultural practices of two hand weedings at 15 and 30 days after sowing. (Table 2) than the rest of the treatments. Because this treatments consumed the maximum energy inputs for their operations,which were markedly higher than the rest of the treatments. Among all the treatments, weed free treatment consumed more energy input than the rest of the treatments except pendimethalin @1.5 kg a.i /ha PE and similarly the lowest energy requirement was found in weedy check treatment compare to the all other treatment and all other treatments were at par among themselves (Table 2).

Energy output:

Among all the treatments weed free (67849.17 MJ/ ha) treatment recorded maximum energy output and weedy check treatment computed minimum energy output (41189.13 MJ/ha) (Table 2) than the rest of all other treatments.In herbicidal treatments, pre-emergence application of pendimethalin @ 1.5 kg a.i/ha computed higher energy output (62415.17 MJ/ha) followed by post-emergence application (15 DAS) of fenoxyprop-p-ethyl @ 0.125 kg a.i/ha i.e (61144.20 MJ/ha) due to its effectiveness in controlling the broad spectrum of annual grassy and broad leaved weeds and results in increased the crop yield. But among the cultural practices, two hand weeding treatment at 15 and 30 days after sowing recorded more energy output (59180.80 MJ/ha) than the other cultural treatment (Table 2).

Energy balance:

Among all the treatments maximum energy balance (66284.83 MJ/ha) was gain in weed free treatment followed by the pre-emergence application of pendimethalin @1.5 kg a.i /ha. i.e. (60843.85 MJ/ha) than the rest of the weed control treatments. But, in

Table 2: Effects of different weed control treatments on energy parameters in black gram

Treatments	Energy output (MJ ha^{-1})	Energy input (MJ ha^{-1})	Energy balance (MJ ha^{-1})	Energy balance per unit input (MJ ha^{-1})	Energy output / input ratio
T_1 - Weed free	67849.17	4693.00	66284.83	14.12	14.46
T_2 -Weedy check	41189.13	4081.00	39828.80	9.76	10.09
T_3 - 2 Hand weeding (15 *fb* 30 DAS)	59180.80	4614.60	57642.60	12.49	12.82
T_4 -2 Hoeing (10 fb 20 DAS)	48715.60	4305.32	47280.50	10.98	11.32
T_5 - Imazethapyr at 50 g/ ha PE (At sowing)	45885.87	4173.94	44494.55	10.66	10.99
T_6 - Imazethapyr at 75 g/ ha PE (At sowing)	53142.43	4203.94	51741.12	12.31	12.64
T_7 - Pendimethalin at 1000 g/ ha PE (At sowing)	60143.40	4513.54	58638.89	12.99	13.33
T_8 - Pendimethalin at 1500 g/ ha PE (At sowing)	62415.17	4713.94	60843.85	12.91	13.24
T_9- Fenoxyprop-p-ethyl at 100 g/ ha POE (15 DAS)	57126.67	4233.94	55715.35	13.16	13.49
T_{10}- Fenoxyprop-p-ethyl at 125 g/ ha POE (15 DAS)	61144.20	4263.94	59722.89	14.01	14.34
T_{11} - Quizalofop-p- ethyl at 50 g/ ha POE (15 DAS)	48169.20	4233.94	46757.89	11.04	11.38
T_{12}- Quizalofop-p- ethyl at 75 g/ ha POE (15 DAS)	53769.23	4293.94	54337.92	12.66	12.99
T_{13}- Imazethapyr at 50 g/ ha PE fb Quizalofop-p-ethyl at 50 g/ ha POE (At sowing fb 15 DAS)	50616.00	4326.88	49173.71	11.37	11.70
SE(m) ±	2415.76	-	2415.30	-	-
C.D.at 5% -	7051.44	-	7050.11	-	-
G.M. -	54718.99	4357.84	53266.38	12.19	12.52

cultural practices of weed control treatments two hand weeding at 15 and 30 days after sowing computed more energy balance (57642.60 MJ/ha) as compared to the other cultural treatment. In all the weed control treatments, weedy check treatment served the minimum energy balance (57642.60 MJ/ha) as compared to all other treatments (Table 2).

Energy balance per unit input:

Weed free treatment recorded maximum energy balance per unit input (14.12 MJ/ha) followed by the post-emergence application 15 days after sowing of fenoxyprop-p-ethyl @ 0.125 kg a.i/ha i.e (14.01) (Table 2) among all the weed control treatments and weedy check treatment required less energy balance per unit input (9.76 MJ/ha)due to kept that plot as it is than the all other rest of the weed control treatments.

Output-input ratio :

Output –input ratio as a whole was observed maximum (14.46) in weed free treatment and minimum (10.09) in weedy check treatment among all the weed control treatments. In herbicidal treatments, post-emergence application (15 days after sowing) of fenoxyprop-p-ethyl @ 0.125 kg a.i/ha recorded maximum output-input ratio (14.34) which was closely followed by the post-emergence application of fenoxyprop-p-ethyl @ 0.100 kg a.i/ha i.e (13.49) (Table 2) than the rest of the all other treatments. In cultural practices two hand weeding at 15 and 30 after sowing recorded more output-input ratio (12.82) than the rest of the cultural treatment (Table 2). In general,extra inputs were responsible for a lower output/input ratio in weed control practices. Higher energy involvement failed to produce correspondingly higher output of energy.

Conclusion:

It can be concluded that the high erenergy output and energy balance were recorded under Pendimethalin 1500 g ha^{-1} PE followed by energy balance per unit input as well as energy output : input ratio were recorded in Fenoxyprop-p-ethyl 125 gha^{-1}POE. Weedy check recorded the overall lowest energy values.

REFERENCES

Ahmed, Y. M., Mustafa, A. S., Reda, L. A., Khozimy, A. M. and Mosteh, Y. Y. (2008). Efficiency of the selected herbicides in controlling weeds and their side effects on peanut. *J. Plant Protection Res.,* **48** (3) : 355-363.

Ali Mohammed and Durai, R. (1987). Control of *Triathema portulacastrum* L. in black gram. *Indian J. Weed Sci.*, **19** (1&2): 52-56.

De, G. C., Chakraborty, T., Modak, R. and Das, S. (1995). Efficiency and economics of integrated weed management in chickpea and blackgram. *Indian Agriculturist,* **39**(3): 213-217.

Malliswari, T., Reddy, M. P., Sagar, K. G. and Chandrika, V. (2008). Effect of irrigation on weed management practices on weed control and yield of blackgram. *Indian J. Weed Sci.*, **40** (1&2) : 85-86.

Mishra, J. S. and Bhanu, C. (2006). Effect of herbicides on weeds, nodulation and growth of *rhizobium* in summer blackgram. *Indian J. Weed Sci.*, **38**(1&2) : 150-153.

Mittal, J. P. and Dhawan, K. C. (1988). *Research Manual on Energy Requirement in Agricultural Sector,* Coordination Cell, CIAE, Bhopal.

Panwar, R.S. *et al.*(1985) . *Annual Conf.Indian Soc.Weed Sci.* held at Varanasi, pp.53.

Raman, R., Kappuswamy, G. and Krishnamoorthy, R. (2005). Response of weed management practices on the growth and yield of Urdbean. *Legume Res.*, **28**(2): 122-124.

Ramanathan, S.P. and Chandrashekharan, B. (1998). Weed management in black gram (*Phaseolus mungo). J. Indian Agron.*, **43**(2): 318-320.

Rao, V. S. (2000). *Principles of weed science* IInd Edn. Oxford and IBH Publishing Co., New Delhi.

Rathi, J. P. S.,Tiwari, A. N. and Kumar, M. (2004). Integrated weed management in black gram. *Indian J. Weed Sci.,* **36**(3/4): 218 - 220.

Sharma, K. K. and Rajkhowa, D.J. (1988). Performance of herbicides for weed control in black gram. *Pesticides,* **22** (6): 39.

Yadav, S. K., Bhan, V. M. and Kumar, Ashok (1985). Nutrients uptake by mungbean and weeds in relation to herbicides. *Indian J. weed Sci.,* **17**(1) : 1-5.