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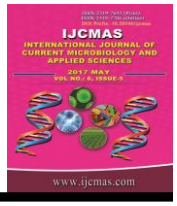

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The Critical Review on Integrated Weed Management in Urd Bean

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A B S T R A C T

The majority of grassy weeds found in urdbean during kharif season include *Echinochloa colona, E. crusgalli*. In India, production of pulses is around 19.3 million tonnes (ESI 2015) with a very low average productivity of 764 kg/ha. Currently, total area under pulses is 26.3 million ha. Their cultivation over poor, marginal and nutrient deficient soils, unfavourable weather conditions, unavailability of quality seeds, poor socio-economic conditions of the growers, and severe weed infestation especially during mansoon season, poor postharvest handling and inadequate market support are some major constraints in realizing the potential of available technologies for the pulse production

Introduction

Urd bean or black gram (*Vigna mungo* L.) is one of the important pulse crops of *kharif* season. It has wide adaptability and can be grown round the year in different agro-ecological regions of the country. It is a rich source of protein (24 %) fat (1.5%) and minerals and plays an indispensable role in human diet and fertility build up of soil. The productivity of urdbean is quite low (473 kg/ha) owing to several constraints. One of the formidable reasons of low productivity of urdbean in *kharif* season is severe weed infestation. Weeds, which emerge simultaneously with the crop grown very fast because of hot and humid weather and offer still competition with crop plant for natural resources at all the stages of growth. The yield reduction in urdbean due to weeds may be as high as 70 % (Dubey *et al.*, 1984). Therfore, it becomes imperative to control weeds at appropriate time.

The majority of grassy weeds found in urdbean during kharif season include *Echinochloa colona, E. crusgalli, Eleusine indica, Cyperus rotundus, C.iria, Cynodon dactylon,* and *Sorghum halepense.*The commen broad leaved weeds are *Trianthema Monogyna, Celosia urgentea, Amaranthus spp, Virdis spp, Cleome viscose, Commelina benghalensis, Cucumis trigonus and physalis minima.*The degree of competition offered by these weeds in urdbean is quite intense at early vegetative stages (25-30 days after

sowing) which is considered as critical period of crop-weed competition (Kasasian and Sceyave, 1969). Weeds remove plant nutrients more efficiently than crop plants.

There are several control measures of weeds i.e. chemical, mechanical and biological control. The chemical control of weeds is more efficient less expensive and time saving, but it cannot completely eliminate the need of manual (mechanical) and cultural practices.

Since application of single herbicide may not be affective in providing broad spectrum weed control, hence, application of pre and post emergence herbicides either in combination or sequence, or integration with manual weeding may be more beneficial. Pertinent review on integrated weed management and its effect on yield and yield attributes of urdbean have been presented here.

Common weed flora in urdbean

Echinoclona crusgali, Digitaria spp, *Cyperus iria* and C.rotundus, among the monocot and *Justica quinquea qualaris*, *Merremia spp*, *Digera muricata*, *Phyllanthus spp* and *Euphorbia spp*. Among the dicot weeds have been reported as common weeds of urdbean (Mehta and Boonlia, 1982) at Kota, Rajasthan. Bisen *et al.,* (1982) reported that the predominant weed species in urdbean at Jabalpur, were *Cyperus spp*. (43.3 %) followed by *Echinochloa spp* (15.3 %) and *Cynodon dactylon* (11.2 %). Singh and Singh (1988) reported the *Echinochloa spp., Ageratum conyzoides, celosia argentea, Euphorbia hirta, Panicum spp, Achyranthus aspera* and *Xanthium strumarium* as the common weeds of urdbean at Ambikapur (M.P.).

The dominant weed flora present in urdbean under Pantnagar conditions were *Echinochloa colona, Cyperus royundus, Eleucine indica, Commelina benghalensis* and *Brachiaria ramose* (Singh *et al.*, 1991). Mishra and Singh (1993) found *Echinochloa spp., Cyperus rotundus, Cleome viscose, Celosia argentia, Cucumis trigonus, Elusine indica* and *Physalis minima* were the most problematic weeds in urdbean at Pantnagar.

In the conditions of Kanpur, *Tranthema monogyna, Echinochloa colona, Cyperus rotundus, Phyllanthus niruri, Dactyloctenium aegyptium, Commelina bengalensis* and *Eclipta* alba as the most problematic weeds of urdbean (Tewari *et al.,* 1993). Sharma and Nayital (1993**)** at Bajaura (Kullu) reported that *Dactyloctenium aegyptium, Digitaria sanguinalis, Eleusine indica, Cyperus rotundus, Cynodon dactylon, Commelina benghalensis, Amaranthus viridis* and *Polygonum spp* were among the common weeds of urdbean, the weeds mostly prevalent in urdbean *Trianthema portulacastrum, Cynodon dactylon* and *Cyprus rotundus* under the conditions of Coimbatore (Ramanathan and Chandra Shekharan, 1998).

Kumar *et al.,* (2000) at IARI, New Delhi reported the major weed *spp* in urdbean were *Dactyloctenium aegyptium, Digitaria sanguinalis, Echinochloa colona, Digera arvensis, commelina benghalensis, Trianthum portulacastrum* and *Amarantus viridis.* Whereas Reddy *et al.,* (2000) reported in the conditions of Rajendranagar, Hyderabad, *Cyperus rotundus, Panicum spp, Echinochloa colona, Amaranthus viridis, Parthenium hysterophorus, Trianthema portulacastrum, cleome viscose, Portulaca oleracea* and *digera arvensis* as important weeds of urdbean crop.

Rao *et al.,* (2001) predominant weed flora of the green gram was comprised of *Acalypha spp., Euphorbia spp., Phyllanthus niruri, Commelina benghalensis cynodon dactylon* and tea weed (*Polypodium lachnopus*).

Losses caused by weeds

Weeds are notorious pests and reduce yield of crop plants by competing for nutrients, moisture, light and space (Tadulingam and Venkatanarayana, 1995b and Isely, 1962). Weeds offer severe competition for essential nutrients like nitrogen, phosphorus and potash (Vengris *et al.,* 1995; Pandey and Rao, 1965). Undoubtedly weeds reduce the yield of urdbean. The degree of reduction varies from place to place depending upon prevailing climate conditions.

Vats and Sawhney,1981 indicated that the loss in grain yield under unweeded check was to the tune of 50 per cent whereas it was 41, 31, and 39 per cent when weeds were removed at 2, 4 and 6 weeks of sowing, respectively. Singh and Singh (1981) reported that under uncontrolled weed situation throughout entire crop season, yield of urdbean and mungbean was reduced by 72 and more than 80 per cent, respectively. The work done at Pantnagar revealed that there was 87 per cent yield reduction in urdbean when weeds competed for full season (Singh *et al.,* 1982). They further observed that yield was reduced by 28.2 and 37.7 per cent when weeds competed with urdbean crop for first 30 and 45 days, respectively. Dubey *et al.,* (1984) reported a yield loss of 70 per cent in blackgram due to weed infestation.

Parto and Prusty (1994) from Bhubaneshwar reported 67.7 per cent reduction in grain yield of mungbean due to weeds. Singh *et al.,* (1996) observed that weed competition with the crop for full crop season resulted in 49 per cent reduction in grain yield of summer mungbean under the conditions of Jabalpur. Reddy *et al.,* 1998 reported that weeds caused 40-50 per cent loss in seed yield in greengram during *kharif*. Kumar *et al.,* (2000) reported that weeds reduced the yield of kharif pulses to the extent of 80-90 per cent due to their competition with crop plants for nutrients, moisture, light and space.

Critical period of weed competition

Critical period of weed competition is the shortest time span during the crop growth when weeding results in the maximum economic returns. A lot of variations in critical period of weed crop competition have been observed from crop to crop at different locations.

Bhan *et al.,* (1970) at pantnagar, recorded 50 per cent reduction in grain of mungbean with one hand weeding had done at 30 DAS as compared to weed free situation upto 60 DAS. Rethinam *et al.,* (1976) reported the initial period as most sensitive to mungbean. Vats and Vasu (1977) concluded that hand weeding done at 30 and 50 DAS were quite effective in controlling weeds. They further indicated that the critical period of crop weed competition in mungbean was from four to six weeks after sowing. Vats and Sawhney (1981) found 4-6 weeks of sowing as critical period of weed competition in urdbean at Ludhiana. Bhan *et al.,* (1982) concluded that hand weeding done at four weeks after sowing increased the yield of cowpea at Hisar. Singh and Singh (1982) from Pantnagar indicated that initial 20-30 DAS in urdbean was most critical for crop weed competition. They further noticed that the maximum yield was obtained from urdbean when kept free from weeds for first 30 days.

Competition for the first 30 days resulted into an average yield reduction of 29.2 per cent, whereas, competition for the 60 days resulted into 71.1 per cent reduction in grain yield (Anonymous, 1984). Munhbean yield was the highest when crop was kept free from weeds during initial 30 days under Junagarh, Gujrat conditions (Raghvansi *et al.,* 1985). The highest grain yield and the lowest weed dry

weight in mungbean field were observed when weeds were removed in between 35 and 45 DAS (Kolar and Dhingra, 1986).

Patro and Prusty (1994) computed the maximum benefit cost ratio (0.95) when weeding was done at 20 and 30 DAS. Singh *et al*., (1996) from Jabalpur indicated that critical period of crop-weed competition in summer mungbean was in between 15 and 45 DAS. Kumar *et al.,* (2000) reported weed removal 25 DAS, reduced the weed population significantly over weedy check.

Effect of inter culture practices on weeds and urdbean

Inter culture practices such as hand weeding by khurpi and hoeing by country plough in between the rows, are chiefly aimed at destroying the weeds.

Panwar and Singh (1977) indicated that yield of mungbean can be doubled by doing hand weeding at 20 DAS and quite effective in controlling the weeds as compared to unweeded plot. The work done at Jabalpur revealed that one hand weeding at 21 DAS in urdbean was the most advantageous and economic (Bisen *et al.,* 1981).

Singh and Singh,1985, reported that two hand wgeeding 20 and 35 DAS led to an enhance of 54.6 per cent increase in grain yield of mungbean over unweeded control and was significantly superior to pendimethalin @ 0.75 kg/ha and closer row spacing (20 cm). Soni *et al.,* (1988), observed that at Jammu single hand weeding done at 20 DAS in urdbean was more effective than one inter-row cultivation. Singh and Singh (1988) at Ambikapur (H.P) found two hand weeding at 20 and 40 DAS significantly superior over to 1.0 kg ai/ha alachlor application in term of yield. While according to Borah (1994) 93 percent and 85 per cent yield of mungbean can increase by one hand weeding at 20 or 30 DAS, over weedy check.

Balyan and Gogoi (1998) under the conditions of Assam reported that one hand hoeing at 20 DAS results the highest grain yield of urdbean and was an economically viable practice with higher weed control efficiency. Kumar *et al.,* 2000 reported that one hand weeding 25 DAS was significantly superior to weedy check. Rao *et al*., (2001) reported that hand weeding, 3 weeks after sowing followed by hoeing, 5 weeks after sowing, recorded higher grain yield than that of pendimethalin spray + hoeing at 3 and 5 weeks after sowing.

Chemical control

Alachlor, metalachlor and pendimethalin are the common herbicides used in pulses. Rao (2000) reported that alachlor shows the effect up to 6-8 weeks and does not last long enough in soil as its half life is 21 days, while metalachlor provides effective weed control for 10-14 weeks having half life as 3-5 months.

At Kanpur by Panwar and Singh (1980), revealed that pre-emergence spray of nitrofen @1.0 kg ai/ha alone or in mixture with alachlor @1.0 kg ai/ha controlled the weeds effectively besides, giving the higher yield of mungbean and maximum net income.

Integrated approach for weed control

Continuous use of herbicides may cause environmental pollution and plants may lead to development of resistance against these chemicals. Therefore, it is necessary to utilize more than one methods of weed control for sustaining the productivity and profitability of crops and cropping system. From different experiment conducted all over country, it can be interpreted that combined use of chemical

and one hand weeding yielded better than any single component.

At Gwalior, Jain *et al*., (1997) compared the efficacy of different methods of weed control in black gram and found that hand weeding at 20 and 30 DAS along with the pre plant application of fluchloralin @1.0 kg/ha was the most effective in controlling major weed flora and produced the highest yield. Use of pendimethalin @1.5 kg ai/ha and one hand weeding at 30 DAS in urdbean field was found to be highly effective in controlling the weeds under the conditions of Coimbatore (Ramanthan and Chandra Shekharan, 1998).

Reddy *et al*., (2000) from Hyderabad, reported that application of any one of the herbicides like pendimethalin, metolachlor and alachlor each @ 1.5 kg/ha to blackgram was very much effective in controlling weeds and gave at par yield to that of hand weeded crop.

Malik *et al*., (2000) from Hisar reported that performance of trifluralin 0.75 kg/ha, linuron 0.75 kg/ha and acetachlor 1.0 kg/ha (all pre emergence) each integrated with one hand weeding at 30 DAS was superior to their alone application against weeds in mungbean. Results of the experiments conducted by Ramamoorthy and Lakshmanachary (2001) in Pondicherry revealed that urdbean produced the highest biomass with pre-emergence application of alachlor @ 1.0 kg/ha + one hand weeding at 20 DAS.

Effect of seed rate on growth, yield and yield attributes

The optimum level of seed rate to be used seems to differ depending upon the environmental conditions, crop species and growth habit. In congenial environment that permits an adequate period for vegetative and reproductive growth, most of the pulses varieties show a little change in yield with large variation in seed rate as has become evident from studies carried out in North India (Panwar, 1978).

In 1992, Gupta observed significantly higher total dry matter accumulation per plant in mungbean at lowest seed rate of 20 kg/ha as compared to 25 and 30 kg/ha. He also reported significant effect of seed rates on initial and final plant population and mortality of mungbean whereas plant stand/ha increased with increase in seed rate from 20-30 kg/ha. Plant height increased with increase in seed rate from 20 to 30 kg/ha, while number of trifoliate leaves was higher at lower seed rate of 20 kg/ha as compared to 25 and 30 kg/ha at all the growth stages in mungbean (Gupta, 1992). At Ludhiana and Sriganganagar in mungbean during spring season a seed rate of 35 kg/ha produced taller plant in comparison to lower seed rate (AICPIP, 1993).

Singh (1993) reported that seed rate of 20 and 25 kg/ha produced significantly smaller plants in mungbean + urdbean crop than that of 30 kg/ha seed rate at maturity, while from Morena, M.P. Tomer *et al.*, (1996) reported that the dry matter accumulation at all growth stages was higher at a seed rate of 20 kg/ha in comparison to 30 or 40 kg/ha.

Pok Padi and Ptradilok (1993) from a field study at Kesetsart University (Thailand) reported that yields of mungbean and urdbean generally increased with increasing plant density while pods per plant were affected adversely. Singh and Sahu (1998) observed no significant response to increasing seed rate from 30 to 35 kg/ha in spring planted mungbean at Pantnagar. Kumar *et al.*, (2000), at Hisar Haryana observed that by increasing plant population increased the grain yield of summer planted mungbean. Rao *et al.*, (2001) conducted the experiment at Bidar Karnataka

and observed that grain yield of green gram differed significantly due to row spacing. The closer row spacing of 30 cm recorded significantly higher grain yield (1214 kg/ha) than 45 and 60 cm.

Effect of weed management on nutrient uptake

Yadav *et al.,* (1985) studied the crop weed competition in mungbean planted during rainy season and observed that weeds removed 132.2 kg nitrogen, 17.6 kg phosphorus and 130.1 kg potassium per hectare in unweeded control, whereas, the crop utilize only 12.4 kg nitrogen, 5.3 kg phosphorus and 10.3 kg potassium per hectare.

Kundra *et al.,* (1991) found that effective weed management through fluchloralin @ 0.75 kg/ha resulted in an uptake of 111.4, 22.7 and 97.5 kg N, P and K per hectare, respectively by the crop and allowed only 3.1, 0.7 and 4.1 kg per hectare NPK to be depleted by weeds. They also observed that pre-emergence application of pendimethalin @ 0.75 kg/ha and two hand weeding (3 and 5 weeks after sowing) also proved equally effective in increasing uptake of nutrients by the crop. Shweta *et al.,* (2005), reported that weed management through application of alachlor @1.5 kg/ha with HW 40 DAS minimum nutrient depletion by the weeds (0.9, 0.2 and 0.8 kg/ha NPK, respectively) and increased the NPK uptake by the crop to the tune of 47.6, 66.7 and 41.8 per cent, respectively over weedy check.

Effect of seed rate on nutrient uptake

Kanungo (1980) analysed mungbean seeds obtained from a field study and reported that total nitrogen, phosphorus and potassium removal was 165.64, 22.70 and 112.33 kg/ha at 20 cm and 130.71,19.34 and 81.09 kg per hectare at 30 cm row spacing, respectively. Rai *et al.,* (1982) reported that phosphorus uptake increased with increased in plant density from 0.25 to 0.5 million plants per hectare. Protein content increased as the plant density was decreased by increasing row spacing from 15 to 30 cm, higher protein content in Mungbean at wider row spacing was also recorded by Jain *et al*., (1988) and Shukla (1991). Singh *et al.,* (1992) observed that the higher content of phosphorus and potassium at 30 cm row spacing.

Singh (1993) from a study carried out during spring season at Pantnagar on urdbean and mungbean reported that protein content of seeds in both the crops did not differ markedly with varying seed rates from 30 to 40 kg per hectare in urdbean and 20 to 30 kg per hectare in mungbean. Also observed that nitrogen, phosphorus and potassium uptake increased with increasing level of seed rate from 20 to 30 kg per hectare.

Singh and Singh (2000) conducted a field experiment on *kharif* mungbean at Pantnagar and observed that total uptake of nitrogen was higher with 2.2 lakh plants per hectare as compared to 3.3 lakh plants per hectare.

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