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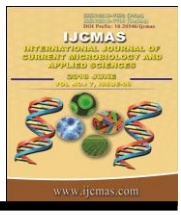

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A Review on Integrated Weed Management in Green Gram

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A B S T R A C T

Although Green gram is the third important pulse crop, it only covers 3.77 million ha land and having a production of 1.52 million tons which is very low compared to other crops. The pulse is widely used as a protein source and fodder crop. The area covered and production is low due to different factors i.e. unavailability of nutrient rich soil, lack of quality seeds, unsuitable climatic factors, traditional cultivation practices, improper weed management, poor postharvest management etc. Among these factors, the improper weed management practices and weed infestation cause the maximum damage to the crop and its production which is the vital constraint reducing the crop potentiality in green gram. Integrated weed management is an important input to the pulse crop to increase its yield and production potentiality by checking the effects of weed infestation, weed competition.

Introduction

Greengram is the third important pulse crop of India in terms of area 3.77 million ha and production 1.52 million tons (DAC, 2015). It is the cheapest source of dietary protein. It can be grown in all the seasons of the year as seed crop also as fodder crop. Green gram improves the soil health and maintains its environment. Weed infestation is one of the major constraints in greengram cultivation and causes 50 to 90 % yield loss (Kumar *et al.*, 2006). Competition with the weeds leads to 30 to 80 % reduction in grain yield of greengram during summer and *kharif* seasons while 70-80% during *Rabi* season respectively. (Algotar *et al.*, 2015). (Sheoran *et al.*, 2008) reported that the weed infestation if not checked within 20 DAS there would be a severe yield reduction to an extent of 38 per cent in contrast to 20 per cent yield reduction with unchecked weed infestation till 20 DAS in greengram. Losses due to uncontrolled weed growth up to95% in wet season and 77% in dry season (Ramanamurthy and Rao, 1996).

Common weed spectrum found in green gram

Weed flora in green gram crop differ from region to region with soil conditions. One should have good knowledge about the persisting weed flora for better management to gain more yield. The major weed flora

found in loamy sandy soil of Bikaner, Rajasthan were *Amaranthus spinosus, Digera arvensis, Trianthemaportulacastrum, Gisekiaporedious, Euphorbia hirta, Aristida depressa, Portulaca oleracea, Cenchrusbiflorus, Cleome viscosa, Tribulus terrestris, Corchorus tridense, Cyperusrotundus, Eleusineverticillata, Eragrastristennela* and *Aervatomentosa* (Komal *et al.,* 2015).

Digitaria sanguinalis, Cynodon dactylon, Eleusine indica, Echinochloa colona among grasses; *Cyperus rotundus* among the sedges and *Cleome viscose, Chenopodium album, Euphorbia hirta, Digeria arvensis, Physalis minima* and *Amaranthus viridis*among the broadleaf weeds were the dominant weeds in sandy loam soil of Nadia, West Bengal (Tamang *et al.,* 2015).

Under clay loam soil of Dharwad, Karnataka; broad leaved weeds (BLW) like *Digera arvensis* Forsk, *Amaranthus viridis* L., *Commelina benghalensis* L., *Cyanotis cucullata* L., *Phyllanthus niruri* L. and *Argemonemexicana*; grasses like *Brachiaria eruciformis* L., *Cynodon dactyl* L., *Digitaria sanguinalis* L. and *Dinebra retroflexa* L., and sedge *Cyperus rotundus* L. are dominant (Shruthi and Salakinkop, 2015).

Panicum colonum L., *Cynodon dactylon* L., *Cyperus rotundus* L., *Digera arvensis* Forsk, *Euphorbia hirta* L., *Leucas aspera* Spreng., *Phyllanthus niruri* L., *Portulaca oleracea* L., *Indigofloraglandulosa* L., *Phyllanthus niruri* L. were found in medium black soil of Junagarh, Gujurat (Chhodavadia *et al.,* 2013).

Cynodondactylon, Dactylocteniumaegyptium, Celotiaargentia, sedges viz. Cyperus rotundus and broad-leaved weeds *viz. Digera arvensis, Trianthemaportulacastrum, Commelinabengalensis, Parthenium hysterphorus, Euphorbia hirta, Hemidismusindica* were found profusely in sandy loam soil of Rajendranagar, Andhra Pradesh (Nagender *et al.,* 2017).

In the sandy loam soil of Nadia, WB; the commonly noticed grass weeds were *Echinochloacolona, Echinochloacrussgalli, Digitariasanguinalis, Eleusineindica*etc; sedge weed was *Cyperus rotundus* and broad-leaved weeds were *Physalis minima, Alternanthera sessilis, Euphorbia hirta, Cleome viscosa, Chenopodium album* etc (Kundu *et al.,* 2009)

The most common weed species observedin clay soil of Navsari, Gujarat were *Echinochloacrusgalli* L., *Cyperus rotundus* L., *Cynodon dactylon* L., *Digeraarvensis Forsk., Digitariasanguinalist* L., *Convolvulus arvensis* L., *Eclipta alba* L., *Amaranthus viridis* L., *Alternanthera pungens, Physalis minima* L., *Trianthema portulacastrum, Sorghum halepense* L., *Vernonia cinerea* L., *Euphorbia hirta* L., *Abutilon theophrasti* (Chaudhary *et al.,* 2016).

Raman and Krishnamoorthy (2005) reported that *Trianthemaportulacastrum, Amaranthus viridis, Phyllanthus niruri*as broad leaf weeds and *Cynodondactylon, Echinochloacolonum* and *Eleusineindica*as grasses were the major weed flora in clayloam soils of Annmalainagar, Tamilnadu in rice fallow season greengram.

Kaur *et al.,* (2009) reported that *Cyperusrotundus, Trianthemaportulacastrum* and *Eragrostistenella* were the major weed flora in sandy loam soils of Ludhiana, Punjab insummer greengram.

The important weed flora in rabigreengram were *Cyprus rotundus, Echinochloacolonum, Digitariasanguinalis, Eragrosits major, Cynodondactylon, Sorghum halepense, Amaranthus viridus, Alternanthera sessilis,*

Euphorbia hirta, Convolvulus arvensis, Ecliptaalba, Vernonia cinerea, Phylanthus maderaspentesis, Physalis minima and *Trianthemaportulacastrum* in Navsari, Gujurat (Raj *et al.,* 2012).

Crop weed competition

Weeds spread easily, because of their enormous seed production and once established are not easily eradicated. Life cycle of most of them coincide with that of crop they invade, thus ensuring mixing of their seed with those of the crops (Mahroof *et al.,* 2009). Due to diversity, weeds are major threat to agriculture and they out-compete crops for natural resources utilization (Chhodavadia *et al.,* 2013). Crop need a weed free period of first 30 days, as the crop is short statured which suffers badly if weeds are not controlled at early stage (Mirjha *et al.,* 2013). Weed competition with mungbean persisting for 20-30 days after emergence was very critical and prolonged competition resulted in substantial yield reduction (Naeem *et al.,* 1999).

Weed competition is very severe during rainy period, particularly at early stages (30 to 45 days after sowing) of the legume crops and hence early weed control is essential (Aktar *et al.,* 2015).

Initial 45 days period is considered to be critical period with respect to crop weed competition in green gram (Singh *et al.,* 1996).

Effect of weed management on yield

Weeds compete with the crop plants for all the resources required for growth like space, water, sunlight and air and cause reduction in crop yield.

Depending on weed type and crop weed competition it reduces crop yield up to 96.5 % (Verma *et al.,* 2015), Whereas the loss of mung bean yield due to weeds rangesfrom 65.4 to 79.0 % (Dungarwal *et al.,* 2003).

Singh *et al.,* (1996) observed that grain yield of summer green gram was reduced by34.88% due to competition with weeds during the first 30 days after sowing which increased to 49.15% when weeds competed with the crop for the entire crop season.

Yield losses in green gram due to weeds have been estimated to range between 30-50 % (Kumar *et al.,* 2004).

Mishra *et al.,* (2000) observed that Competition with the weeds throughout the crop season reduced the seed yield of mungbean by 83.3% and from a field experiment, Shuaib (2001) reported that weed competition reduced mungbean yield to the tune of 65.4 percent.

According to Randhawa *et al.,* (2002) seed yield reduction upto 46.8% due to unweeded control; whereas according to Raman and Krishnamoorthy (2005) presence of weeds reduced the seed yield of mungbean by 35%.

Dungarwal *et al.,* (2003) observed that the loss of mungbean yield due to weeds ranges from 65.4% to 79.0%.

Effect of weed management on nutrient uptake

Komal *et al.,* (2015) conducted an experiment in kharif season at Bikaner, Rajasthan and found that weeds uptake 61.9 kg nitrogen, 12.1kg phosphorus and 51.3 kg potassium per hector whereas uptake by the crop was only 45kg nitrogen, 6.02 kg phosphorus and 46.3 kg potassium per hector respectively in weedy check plot.

Studies conducted at Junagadh (Gujarat)

during summer season revealed that maximum amount of nutrient was up taken by weeds in weedy check plot i.e. 31.0, 28.7, 1.9 kg ha $^{-1}$ nitrogen, phosphorus and potassium and it was minimum in case of the crop i.e. 18.2. 24.9 and 4.7 kg ha $^{-1}$ nitrogen, phosphorus and potassium whereas the crop uptake was maximum of 23.0, 40.5 and 7.8 kg ha $^{-1}$ nitrogen, phosphorus and potassium in weed free plot (Chhodavadia *et al.,* 2013).

Kaur *et al.,* (2010) carried out an experiment on summer mungbean at Ludhiana, Punjab during summer 2003 to study the effect of weed control in summer mungbean and the results revealed that the maximum nutrient removal by weeds was observed in unweeded control i.e. 68.90, 19.29 and 77.17 kg ha-1 of N, P and K respectively and the minimum in case of pendimethalin 0.75 kg ha^{-1} i.e. 8.70, 3.17 and 11.57 kg ha^{-1} of N, P and K respectively. They further noted that two hoeing at 25 and 40 DAS removed the highest amount of nitrogen i.e. 107.78 kg ha^{-1}. Similarly, phosphorus removal by the crop was the highest in two hoeing with wheel hoe at 25 and 40 DAS and high potassium uptake (82.71 kg ha-1) was in pendimethalin 0.75 kg ha^{-1}.

Weed management strategies

Mechanical and manual weeding

From the experiment conducted by Algotar *et al.,* (2015) at Navsari (Gujarat), it is concluded that keeping the field weed free up to harvest (2 hand weeding and hoeing) gives the highest grain and haulm yield.

Chaudhari *et al.,* (2016) indicated that hand weeding at 20 and 30 DAS and hand hoeing at 20 and 30 DAS lead to an enhancement of 3.4 %, 3.6 % yield of summer green gram over weedy check.

Chhodavadia *et al.,* (2014) at Junagadh (Gujarat) found that hand weeding at 20, 30 and 40 DAS reduced weed infestation most efficiently throughout the growing period of the crop and as a consequence it produced the highest seed yield of summer green gram.

Patel *et al.,* (2015) observed that at Anand (Gujarat) inter culturing followed byhand weeding carried out at 20 and 40 DAS was more effective in controlling weeds and gave more yield as compared to pendimethalin 500 g/ha as PE *fb* IC + HW at 30DAS.

Patil *et al.,* (2014) reported that at Akola, Maharashtra, hand weeding + 1 hoeing increased the grain yield by 68.9% over control.

Patel *et al.,* (2015) at Navsari, Gujurat concluded that two hand weedings along with hoeing at 20 and 40 DAS or two hand weedings at 20 and 40 DAS are found most appropriate and profitable weed management practices.

Chemical control

As manual weeding islaborious and time consuming so farmers prefer for chemical weed control.

Poornima *et al.,* (2017) concluded that the combinations of Haloxyfop-p-methyl at 135 g/ha + Imazethapyr at g/ha, and Quizalofop ethyl at 50 g/ha + Imazethapyr at 75 g/ha applied at 12-15 days after sowing of green gram as an early post-emergence can be recommended for weed control in greengram in Southern Zone of Telangana for getting higher yield during kharif.

Application of Vellore 32 (Pendimethalin 30 EC+ Imazethapyr 2 EC)@1.00 kg a.i. ha^{-1} was found most effective in reducing population and dry mass of weeds and producing maximum yield of green gram at

Nadia, West Bengal (Tamang *et al.*, 2015). Singh *et al.*, (2016) conducted an experiment at Bihar and concluded that application of herbicide Pendimethalinat 1.0 kg ha^{-1} as pre-emergence was most effective and superior no application of herbicides for controlling of weeds and achieving maximum seed and stover yield of green gram.

Ali *et al.*, (2011) in Sardarkrushinagar (Gujarat) concluded that under constraints of labour availability, maximum yield, net profit and effective weed control in green gram crop can be achieved with application of Imazethapyr or Quizalofop-p-ethyl 100 g/ha 15-20 days after sowing.

Integrated weed management

The conventional methods of weed control (hoeing or hand weeding) are labour intensive, expensive, insufficient and may cause damage to the crop. Chemical weed control isnot common as the use of herbicides may beuneconomical due to low yield potential of greengram (Reddy, 2004). So, to avoid the ill effects of using a single method, use of integration of all possible methods can prove better yield and maximum benefit.

Singh *et al.*, (2015) concluded that Pendimethalin (pre) 1000g a.i./ha +1 hand weeding minimizes total weed density throughout the crop growth period and produces maximum yield.

At Navsari; Raj *et al.*, (2012) conducted an experiment during 2005-2008 by comparing different methods of weed control and concluded that higher seed and haulm yields with higher weed control efficiency were obtained with two hoeing at20 and 40 DAS and was followed by pendimethalin aspre-emergence 0.75 kg/ha + one hand weeding at 40DAS.

Kundu *et al.*, (2009) from Nadia, West Bengal reported that integrated weed management practices with quizalofop-p-ethyl @ 50 g a.i. ha^{-1} at 21 DAE + hand weeding at 28 DAE produced the highest yield attributes, seed yield and benefit: cost ratio in mungbean cultivation compared with application of herbicide alone.

Raman and Krishnamoorthy (2005) in Annamalai Nagar revealed that green gram produced highest yield with the application pendimethalin @ 1.0 kg/ha plus one hand weeding on 20 DAS.

From the above stated reviews, it is revealed that weeds cause a great loss in crop production and they should be managed to an extent that there should no economic losses due to weeds. Due to shortage of labor and environment polluting effects of chemicals it is necessary to adopt integrated weed management for sustainable development and higher yield potential of green gram crop.

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