

Importance of Weed Management in Sugarcane (*Saccharum Officinarum* L.)

Weeds are ubiquitous and insidious tyrants on earth. Their presence in and around agricultural land results in severe losses. But their menace is often ignored because they lack publicity of sudden outbreaks, as is commonly exhibited by several plant diseases and insect pests. The sight of an uniformly suppresses growth of a weedy crop often does not distract a passer-by till it comes to harvesting. Even then, there is tendency to ascribe the low yields to causes other than the weeds. But the fact remains that directly the weeds reduce the crop yields and indirectly they elevate farm production costs through energy spent in controlling them. Further the negative effects of weeds are depicted during harvesting, marketing and storage of the weedy crops. Added to this, there is increased incidences of pests and diseases in different crops in the succeeding years. According to an estimate, collective crop losses due to weeds, insect pests and plant pathogens in 2006-07 in India is to the tune of Rs. 14 lakh million. The weeds are notorious in being responsible for major part of this losses (about 40% or so). Weed management is the application of certain principles and suitable methods that will improve the vigor and uniform stand of the crop. At the same time avoid or discourage the invasion and growth weeds. Weed control is an essential part of all crop production systems. Weeds reduce yields by competing with crops for water, nutrients and sunlight and may directly reduce profits by hindering harvest operations, lowering crop quality and producing chemicals which are harmful to crop plants (alleopathy). Left uncontrolled, weeds may harbor insects and diseases and produce seeds, rootstocks, stolons, rhizomes or stem cutting which infest the field and affect future crops.

Providing a weed-free environment in sugarcane is absolutely essential to realize the full potential of a variety and to make best use of the key production factors like nutrients, moisture and other natural resources.

Damage / losses caused by weeds in sugarcane:

- In India, the reported cane yield losses range from 12 to 72 per cent. If weeds are not properly controlled in the initial stages, the yield loss could go upto 17.5 t/ha. Twining weeds which sprout at later stages and twine around clumps affect cane growth and cause around 25 per cent loss in yield. The total cane yield loss in the country per annum is around 25 million tones (equivalent to 2.5 million tones of sugar) valued around Rs. 1500 crores.
- Poor growth of sugarcane resulting from weed infestation also causes quality depression in sugarcane. Weeds harbor certain disease and insect pests that attack sugarcane and thus lead to indirect losses.
- Bermuda grass (*Cynodon dactylon*) the cogon grass (*Imperata cylindrica*) and other graminacious weeds are known to be alternate hosts to Ratoon Stunting Disease (RSD) of sugarcane.
- Twining weeds like *Ipomoea* spp. are becoming a problem in many sugarcane growing areas, escalating cost of cultivation besides decreasing cane yields. The twining weeds also cause serious harvesting problem.

- Striga is creating a great problem in Belgaum, Bagalkot and Bijapur districts and threatening cane cultivation in these areas.
- Weeds remove four times of N and P and 2.5 times of K as compared to sugarcane during the first seven week period.

Period of weed growth and critical period of crop-weed competition:

Weeds interfere with crops at anytime they are present in the crop. The period at which maximum crop weed competition occurs is called as critical period which is the shortest time span in the ontogeny of crop when weeding results in highest economic returns. As a thumb rule, first $\frac{1}{4}$ - $\frac{1}{3}$ of the growing period in many crops is critical period. The duration of a sugarcane crop is 12-16 months. So, in cane, the initial 120 days can be considered as critical period for crop-weed competition.

In general for most of the annual crops first 30-40 days weed free period is very important. In a situation, where weeds germinate late, as in case of sugarcane, the late stage weeding is also more useful as early weeding. So, weeding around 100-120 days or 120-150 days after planting cane (variety dependent) is as important as early weeding done in the initial crop growing period (30-40 days), as weed seeds keep on germinating because of wide row spacing and sun light reaching in the exposed inter row spaces (until full crop canopy development). Subsequently, frequent irrigations, heavy fertilizer dose and high temperature induce a number of new flushes of weeds, both grasses broadleaf's. Bermuda grass (*Cynodon dactylon*), nutsedge and several species of morning glories (*Ipomoea* spp., *Convolvulus* spp. etc) pose special weed problems in sugarcane in different areas.

Weeds interfere with crops at anytime they are present in the crop. Thus weeds that germinate along with crops are more competitive. Sugarcane takes about one month to complete its germination phase, while weeds require very less time to complete its germination. During this long period, a variety of weeds grasses, broad leaved weeds including *Cynodon* and nutsedge, invade the sugarcane fields. These weeds reduce crop germination and early crop vigour. By that time crop plants are usually smothered by the weeds completely. Weed management in the early stages is very important since heavy infestation prevents proper bud germination. The smothering effect of weeds on the crop is also observed for about 4-5 months after planting i.e. during tillering and elongation phases. Due to shading, sugarcane tillering is affected. This leads to inadequate initial population which ultimately results in lower stalk population i.e. less number of millable canes per unit area. Internodal elongation is also adversely affected resulting in damage by way of reduced length and girth of internodes which amounts to reduced size of sugar bags. Weed competition will ultimately have an adverse effect on cane yield and sucrose content in juice. There is a negative correlation between weed population and millable cane as well as between yield and sucrose content in juice. Sugarcane tonnage is reduced heavily at the hands of weeds, if these were left uncontrolled. Besides, the stunted weedy canes become bunchy because of forced germination of their buds on the shoots. A weedy plant cane leads to a weedy ratoon cane.

Common weed flora:

During the initial 100-120 days period much of the soil, space, sunlight etc. are left unutilized by the sugarcane crop. Taking advantage of this situation, weeds grow luxuriantly and cause serious damage. Most common weeds of sugarcane in India are *Cyperus rotundus* (sedge), *Cynodon dactylon*, *Digitaria sanguinalis*, *Dinebra retroflexa*, *Eleusine indica*, *Panicum* spp., *Dactyloctenium aegyptium* (among grasses) *Chenopodium album*, *Trianthema portulacastrum*, *Trianthema monogyna*, *convolvulus arvensis*, *Amaranthus viridis*, *A blitum*, *Digera arvensis*, *Portulaca oleracea*, *Lactuca runcinata*, *Euphorbia hirta*, *Euphorbia geniculata*, *Eclipta alba*, *Commelina benghalensis*, *Digera arvensis*, *Phyllanthus niruri* and *Ipomoea* spp. (among broad leaved weeds) etc. If these weeds are not controlled from very beginning the reduction in sugarcane yield may be severe. The most critical period for the weed competition in sugarcane is up to 4-5 months after sowing beyond which the crop smothers the weed flora by itself.

Weed Management:

The healthy crop stand is primary to any weed management programme in sugarcane. In weak and gappy cane adequate weed control is hard to achieve. Physical control of weeds in sugarcane begins with a blind hoeing before the cane sprouts are seen above the ground. Later, during the tillering phase of the crop, manual and mechanical row cultivations are done 2-3 times during the season. Finally the crop earthed up, just before it enters its grand growth period. By this time a healthy crop of cane should close in sufficiently to smother any new weed seedling, *Ipomoea* spp., *Convolvulus arvensis* and the like trailing weed species, may however still survive by climbing the cane plants. Physical methods work out to be costly. May time labours and bullock pairs are not available. Because of this farmers face lot of problems in attending to the important operation of timely weeding. Herbicides can be very usefully employed to supplement physical control of weeds in sugarcane to achieve higher yield targets and to lower the labour requirement.

Effective weed control in sugarcane can be achieved by adopting various known approaches of weed management. One has to avail the excellent quality herbicides that have a great promise in controlling all kinds of weeds in sugarcane.

Herbicides are being extensively used for weed control in many sugarcane growing countries of the world for the following reasons.

- Labour is becoming scarce and costly.
- Conventional methods are inefficient
- Initial weed growth cannot be controlled by conventional methods
- Timely weeding is becoming difficult by conventional methods and
- Conventional methods are becoming time consuming and costly.

Pre-emergence application of a herbicide is essential to control initial weeds. This is done soon after planting as a blanket spray on the third or fourth day. Later on, another

application around 35 – 40 days with a post-emergence herbicide may be required as directed spray on to the foliage of the weeds.

Pre-emergence application of triazine compounds (atrazine, simazine etc.) resulted in high mortality of weeds in sugarcane fields.

A large number of experiments throughout the country have indicated that for sole crop of sugarcane, atrazine is the most effective herbicide at dosages ranging from 1.25 to 2.0 kg/ha. It controls most of the seed germinated broad leaved weeds and few grasses when applied as pre-emergence spray.

Metribuzin, diuron and alachlor as pre emergence herbicides, have also been found to be effective.

Post-emergence application of 2,4-D at 1.0 to 1.5 kg/ha (sprayed on weeds between 40 and 60 days) has been found highly effective in controlling most of the broad leaved weeds.

Atrazine, Metribuzin and 2,4-D have become a very popular herbicides throughout the state. They give a more or less complete weed free condition for about 50 to 60 days.

Post-emergence application of paraquat dichloride and glyphosate applied between the rows as directed spray on weeds can control wide variety of weeds. Especially glyphosate being translocated herbicide has a great promise in controlling pernicious weeds like *Cynodon dactylon* and *Cyperus* spp., in widely spaced can crop. A hood should be used specially when glyphosate is applied to target/kill only weeds and to safeguard the crop, as such a protection on the nozzle avoids spray drift reaching the crop.

A follow up application of herbicide will be needed when pre-emergence herbicides are applied in July and August to prevent re-establishment of summer weeds and to control winter weeds.

For controlling twining weeds such as *Ipomoea* spp. and *Convolvulus* spp., application of atrazine (1 kg/ha) or metribuzin (1kg/ha) may be done between the cane rows after final earthing up. 2,4-D Sodium salt (1-2 kg/ha) can be sprayed on such emerged / grown up broad leaved weeds depending upon their growth stage.

For *Striga* infested cane fields, the same herbicides recommended for controlling twining weeds above, can be used. The trials conducted by UAS, Dharwad on farmers' fields have revealed that the herbicide mixtures / combinations of either atrazine + 2,4-D or metribuzin + 2,4-D at 100% or 75% of their recommended doses applied after final earthing up i.e. around 100 days after planting (usually when *Striga* starts emerging) and subsequent 2-3 applications at an interval of 30-40 days can effectively control this parasitic weed.

Higher doses of N fertilizers and frequent irrigations are to be applied specially in the Striga infested patches. After final herbicide treatment in these patches, mulching is to be done.

The herbicides that can be used in cane are given below with dosage and time of application:

Herbicide recommended a.i.kg/ha	Quantity of formulated product Kg/ha	Time of application	Remarks
Atrazine 1.25 kg/ha	Atrazine 50 WP 2.5 kg/ha	PRE-3-4 DAP and at final earthing up	Use higher rate on heavy soils or when sugarcane is planted in July or August
Metribuzine 1.0 kg/ha	Metribuzin 70 WP 1.5 kg/ha	PRE 3-4 DAP and at final earthing up	This product is safe to use on all soils and varieties of sugarcane. Use higher rate on heavy soils or when sugarcane is planted in July or August.
Diuron 1.0 kg/ha	Diuron 80 WP 1.0 kg/ha	PRE 3-4 DAP	Use higher rate on heavy soils or when sugarcane is planted in July or August
Pendimethalin 1.0 kg/ha	Pendimethalin 30 EC 3.3 litres/ha	PRE 3-4 DAP	May be soil applied or incorporated. Use higher rate on heavy soils if surface applied when planting in July or August
Alachlor 1.5 kg/ha	Alachlor 3.0 liters/ha	PRE 3-4 DAP	Use higher rate on heavy soils or when sugarcane is planted in July or August
2,4-D 1.0-2.0 kg/ha	2,4-D 1.25-2.0 kg/ha Or 3.0 liters/ha	POST 60 DAP	Follow up applications
Paraquat dichloride 0.5-1.0 kg/ha	Paraquat dichloride 24% EC 2.0-4.0 liters/ha	POST and as Follow up applications	Use dosage depending on the stage of the weeds. Directed spray on weeds. Can also be used just before emergence of crop, to destroy weeds appearing prior to crop germination.
Glyphosate 1.5 – 2.0 kg/ha	Glyphosate 71 SG 2.0 – 3.0 kg/ha	Effective against all weeds except perennial weeds	Directed spray on weeds. Use a hood to target only weeds. There should be target only weeds. There should not be any spray drift to crop.

PRE = Pre emergence POST = Post emergence DAP = Days after planting

Whenever pulse crops (mung, cowpea), groundnut, sunflower, maize, wheat, potato, gram, onion etc. are grown as intercrops in sugarcane, alachlor or pendimethalin are found useful under intercropping. Farmers should consult scientists before taking up such applications.