

## **NEW FORMULATION OF GLYPHOSATE AND RECENT DEVELOPMENTS ON THE USES OF GLYPHOSATE IN INDIA**

**Abhijit Bose<sup>1</sup> and M.C. Pandey**

### **ABSTRACT**

*Glyphosate usage is much lower in developing countries. Labour availability for weed control is a big question. Time available for de-weeding operations is also very less. Cost involved in manual weed control is very high. Cyperus and Cynodon multiply very fast after manual weed control. Successful weed control depends on interactions between weeds (growth habit/size), environmental factors (light, temperature, moisture, wind) and quality of the spray solution. The environment plays major role in the physical development of plants. The size, shape, and thickness of leaves, cuticle, wax deposition, and changes in the water and nutrient status within plants are crucial. These changes affect glyphosate efficacy in several ways viz., interception, retention, penetration, translocation to the site of action. Prevailing environmental conditions also, before, at and after application affect glyphosate performance. Actively growing plants are ideal for glyphosate penetration and retention. Rain and high wind at time of application are not desired at all. Glyphosate inhibits the shikimate pathway enzyme EPSPSase; the enzyme that acts late in that pathway. Glyphosate reduces the weed population and their decomposition makes the soil porous. Glyphosate usage other than in orchards are pre tillage / post harvest, pre harvest, after sowing before germination, before sowing/germination, inter-row and non-crop area. Through Herbidisk in segments like PT/PH, time, labour and water can be saved. However, for sure adjuvant gives better rainfastness.*

**Key words:** cotton, Excel Mera 71, glyphosate, weed control.

### **INTRODUCTION**

Excel Mera 71(a new 71% WDG formulation of Ammonium Salt of Glyphosate) gives quicker and higher absorption of glyphosate. Better management of broad leaf & hardy weeds and good rain fastness. It is effective at lower dosage ha<sup>-1</sup>. Product can be easily transported to the point of consumption. This formulation can be better used in cotton for weed management in interrows with the help of foam nozzle and guard. Cleaning of bunds & channels and

---

<sup>1</sup> Excel Crop Care Limited, 13, Aradhana Industrial Development Corporation, Near Virwani Industrial Estate. Goregaon (East), Mumbai 400063. India. Corresponding author's email: [abhijitbose@excelcropcare.com](mailto:abhijitbose@excelcropcare.com)

surroundings helps in reducing the alternate hosts of mealy bug and CLCV. Sanbagavalli *et al.* (2009) in an experiment observed that presowing weed control through SSB (Stale Seed Bed) by glyphosate with post sowing method of hand weeding twice recorded significantly higher seed cotton yield (1815 kg ha<sup>-1</sup>) and was comparable with pendimethalin 1.0kg ha<sup>-1</sup> followed by one HW on 45 DAS (1798kg ha<sup>-1</sup>). For effective control of *Rottboellia cochinchinensis*, pre – emergence application of pendimethalin 1.5 kg ha<sup>-1</sup> in cropped fields and post emergence spraying of glyphosate 3.0 kg ha<sup>-1</sup> under non crop or fallow seasons effectively manages *Rottboellia cochinchinensis*, a thorny problematic grassy weed in black clay soils of Tamil Nadu (Nithya *et al.*, 2009). Ravisankar *et al.* (2009) reported that tuber treatment with cytokinin (0.01%) followed by application of glyphosate @ 3.0 kg ha<sup>-1</sup> on third day controlled the tuber emergence by 92%. Whereas, Prabakaran *et al.* (2009) observed directed application of glyphosate 41% SL @ 15 ml / lit.<sup>-1</sup> of water could reduce the density of *Cyperus rotundus* effectively. Higher yield and economic returns were obtained in glyphosate 41% SL 15 ml lit.<sup>-1</sup> of water.

#### **Weed Management with Glyphosate: Major Highlights 2009-10**

Very recently a lot of work on glyphosate has been carried out in India especially in Southern and Western parts. Results are promising and farmers are using this herbicide for the weed management in their crop fields on large scale. However, it has been noticed that a few hard –to- kill weed species have started showing resistance against IPA salt of Glyphosate 41 SL formulation . The application of Excel Mera 71 (Ammonium salt of Glyphosate 71% SG ) have shown remarkably better result against such hard –to-kill weed species.

#### **Cotton**

Wider spacing of cotton and slow growth during initial stages results in luxurious growth of weeds. Timely weeding after the crop emergence is not feasible due to demand and cost for agricultural labourers and frequent rainfall in the monsoon season. These warrant the adoption of pre-sowing weed control method i.e., Stale Seed Bed (SSB) in order to reduce the weed competition after the establishment of the crops.

Stale seedbed may be defined as a seedbed prepared several days, weeks or months prior to sowing or planting a crop. Weed seeds in the surface layer of the soil are induced to germinate, emerge and controlled before cropping so that a part of weed population could be eliminated by pre-plant shallow tillage or by post emergence non selective herbicide spray. Yield loss of 56-85% was observed in cotton grown under un-weeded condition. Weeds remove 30-50% of applied nutrients and 20-40% of available moisture besides reducing the yield

and quality of the produce. Sanbagavalli *et al.* (2009) reported SSB by glyphosate either with hand weeding (HW) or pendimethalin 1.0 kg ha<sup>-1</sup> followed by one HW on 45 DAS recorded maximum B:C ratio. SSB by Glyphosate + Pendimethalin 0.5 kg ha<sup>-1</sup> followed by one HW on 45 DAS registered comparatively higher B:C ratio of 2:30 than SSB by cultivation (2:05) and conventional seedbed preparation (1:83) with all the post sowing weed management treatment combinations. So, there is the possibility of reducing half of the recommended pendimethalin to cotton crops and one hand weeding to green gram by adopting pre sowing SSB technique. In another study, Sanbagavalli *et al.* (2009) concluded that pre-sowing weed control through SSB by Glyphosate with post-sowing hand weeding twice recorded significantly higher seed cotton yield (1815 kg ha<sup>-1</sup>) and was comparable with Pendimethalin 1.0 kg ha<sup>-1</sup> followed by one HW on 45 DAS (1798 kg ha<sup>-1</sup>). Pendimethalin 0.5 kg ha<sup>-1</sup> followed by one HW on 45 DAS with SSB Glyphosate exhibited seed cotton yield (1701 kg ha<sup>-1</sup>) higher than that of conventional seedbed + HW twice (1435 kg ha<sup>-1</sup>).

*Solanum elaeagnifolium* (Silver Leaf) is a perennial weed that has become increasingly troublesome over the past several decades. Extensive use of soil-applied herbicides, accompanied by a reduction in annual weed competition and reduced tillage, has contributed to its spread and establishment as a noxious weed in cultivated fields. Cotton yields have been reduced by 75% and in cereals 12% grain yield reduction. Its problem is more aggressive in black clay soils where the dominant crops are cotton, maize and sunflower. Priya *et al.* (2009) have reported that post-emergence application of glyphosate 10 ml + 2,4-D 6 g + soap solution 2 ml per litre of water reduces the infestation of *Solanum elaeagnifolium* distinctly.

### **Banana**

Bananas are planted in wider spacing and being perennial, slow growing at early stages give scope for stiff weed competition. *Portulaca quadrifida* is an annual weed which multiplies with seeds as well as vegetative fragments with inter-nodes. It is a common weed in garden land crops like banana. Srinivasan *et al.* (2009) observed higher yield and economic returns in bananas when weed management was carried out with glyphosate.

### **Hard to Kill - Weeds**

#### ***Tithonia rotundifolia***

*Tithonia rotundifolia* is a noxious weed which belongs to the family Asteraceae, a native of Northern America named as Mexican-sunflower. It is an annual monocarpic plant and seeds exhibit a period of dormancy before germinating. *Tithonia rotundifolia*, is an agricultural weed, casual alien, cultivation escape and noxious weed.

The invaded weed into the black soils of Slur areas of Coimbatore district has been identified as *Tithonia rotundifolia* (Mill.) Blake. This produces small-size seeds with high reproductive ability. Entire or lobed dark green leaves (3-6" long) with hairy undersides are generally ovate to triangular in shape with serrated margins. Leaves are spindled shape with shallowly incised at the base and thin hairy in nature with parallel venation. Leaf arrangements are alternate and opposite. Stem is succulent and angular and roots are adventitious and runners. Flowers have yellow colour petals and ray florets are solitary and terminal heads. Mynavathi *et al.* (2009) have reported that post-emergence application of Glyphosate @10 ml/L + 2, 4-D 6 g/L + soap solution 2 ml lit.<sup>-1</sup> of water could reduce the *Tithonia* density as well as biomass considerably. For effective control of *Tithonia rotundifolia*, repeated spraying of glyphosate @ 10 ml/L + 2, 4-D 6 g + soap solution 2 ml lit.<sup>-1</sup> of water at an interval of 30-40 days under non-crop situation is recommended. Excel Mera 71 (A.S. of Glyphosate 71% SG) @ 10g / L of water has shown considerably better control over a period of 45-50days.

#### ***Rottboellia cochinchinensis***

*Rottboellia cochinchinensis* is a C4 species is a most problematic weed in rainfed crops and common on contour banks and roadsides. This is one of the primary colonizers of disturbed ground. Rapid growth and sharp irritating hairs, make it very competitive. The thorny nature of this weed hinders manual removal warranting herbicidal control.

*Rottboellia cochinchinensis* is observed to invade black soils of Madurai, Coimbatore and Thirunelveli districts. It reproduces entirely by seeds and continues to flower and seed year-round and a single plant can bear 2,000 seeds. The weight of 1,000 seeds is 10.6 g. Leaf blades broadly linear, up to 45 cm long and 2 cm wide, rough on both sides, sheath wide open, lower part of central nerve inflated, with bristle like hairs along sheath. Ligule membranous and short, 1 mm long. Culms stout, growing to a height of 1-3 m, occasionally branching. Inflorescence a simple raceme, spike like, contracting at the tip, cylindrical. Fruit is a cylindrical caryopsis. Nithya *et al.* (2009) have reported pre-emergence application of pendimethalin 1.5 kg ha<sup>-1</sup> in cropped fields and post-emergence spraying of IPA salt of Glyphosate 3.0 L ha<sup>-1</sup> under non crop or fallow seasons could control the weed effectively. Spraying of Excel Mera 71 @ 2 kg ha<sup>-1</sup> has shown better control over a period of 45-50 days.

#### ***Cyperus rotundus* L.**

*Cyperus rotundus* is one of the most harmful perennial weed species with rapid growth that causes hindrance to agronomic practices of crops grown in tropics. The weed multiplies through

rhizomes and tubers that of underneath the ground up to the depth of 90 cm. All the commercial herbicides available in the market aimed to control or kill growing above ground part of the weed plants. None of the herbicides inhibit active viable underground plant parts like rhizome or tubers which act as a source for new plants in the next season. Ravisankar *et al.* (2009) observed that tuber treatment with cytokinin at 0.01 per cent followed by herbicide spray with glyphosate 3.0 kg/ha (3 days after tuber treatment) killed the induced bud sprout (by cytokinin) by 92 per cent under laboratory condition. Excel Mera 71 @ 2 kg ha<sup>-1</sup> has remarkably better control of *Cyperus rotundus* under field condition.

*Cyperus rotundus* is a perennial from rhizomes and tubers and thrives in moist soils and is spread by flood water and cultivation. It is a common weed in garden land crops like banana, grapes, tapioca, cotton, chillies and other vegetable crops.

It is not controlled by most commonly used herbicides. Prabhakaran *et al.* (2009) reported effective control by glyphosate 41% SL @15 ml / litre of water. It reduced the weed density and weed dry weight considerably.

## **CONCLUSION**

A number of diseases and insect-pests first appear on perennial weeds and then they migrate to main crops. Sheath blight and false smut first invade *Cynodon* and then infect paddy. Similarly loose smut gets transferred from *Cynodon* to wheat. Mealy bug has been noticed on *Parthenium* when cotton is not there in the field. These hard to kill weeds can be managed successfully by the application of Excel Mera 71 (Ammonium salt of Glyphosate 71% SG). We need to keep surrounding of the crop fields weed free. Farmers are advised to go for weed control on bunds & channels and nearby fallow land.

Thus the new formulation of Glyphosate (Excel Mera 71) shows a good prospect in the management of a broad spectrum of weed flora and specially hard-to-kill weeds. Results from Excel Mera 71 have been far superior to other formulations of post-emergent herbicide at farmers' field due to its different chemistry and formulation. The farmers also find it easier to handle due to the nature of formulation (water soluble granule).

## **ACKNOWLEDGEMENTS**

The authors are thankful to the management of M/S. Excel Crop Care Limited, Mumbai, India for constantly encouraging .work on perennial weed management and providing the necessary facilities to compile the available information. We would also like to thank the people working in the fields with the farmers on the concept of clean

cultivation. Our sincere thanks are also due to the young scientists whose work has helped us to reach to the conclusion. We also express our gratitude to the Dr Jay G. Varshney, Director, Directorate of Weed Science Research (DWSR) Jabalpur, India for providing a platform for scientist - industry interaction at weed symposium on, 02.08.09, TNAU, Coimbatore, India.

#### REFERENCES CITED

- Mynavathi, V.S., C. Chinnusamy, and P. Muthukrishnan. 2009. *Tithonia rotundifolia* an invasive poisonous weed and its post emergence herbicidal management in western zone of Tamil Nadu. TNAU, Coimbatore. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.
- Nithya, C., V.S.Mynavathi, and C. Chinnusamy. 2009. *Rottboellia cochinchinensis*- A thorny problematic grassy weed in black clay soils of Tamil Nadu. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.
- Prabakaran, N.K., C. Nithya, and C. Chinnusamy. 2009. Post emergence herbicidal management of perennial sedge (*Cyperus rotundus* L.) in banana. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.
- Priya, R.S., C. Chinnusamy, and N.K.Prabhakaran. 2009. Post – emergence herbicidal management of *Solanum elaeagnifolium* in crop fallow conditions under rainfed ecosystem. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.
- Ravisankar, D., C.R.Chinnamuthu, and P. Srimathi. 2009. Pre – emergence control of purple nut sedge (*Cyperus rotundus* L.) using growth promoting substances in combination with herbicides. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.
- Sanbagavalli, S., O.S.Kandasamy, K. Sathyamoorthi, and V. Ganesaraja. 2009. Effect of stale seedbed technique of weed management on yield and economics of cotton-green gram cropping systems. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.
- Srinivasan, S., N.K.Prabhakaran, and C. Nithya. 2009. Efficacy of post emergence Non – Selective herbicidal management of *Portulaca quadrifida* in Banana. Poster in weed symposium, 02.08.09, TNAU, Coimbatore.