Proceedings STAI, Sugarcane Agriculture
Vol. 82 (2024) : 34-39 doi: 10.69794/82SAC/978-81-969264-0-3/34-39

Studies on Integrated Approach for Curtailing the Menace of *Striga* – A Parasitic Weed of Sugarcane

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Received : June 07, 2024; Accepted : June 20, 2024

ABSTRACT

Field studies were conducted to study the effect of integrated approach for curtailing the menace of *Striga,* a parasitic weed of sugarcane at various farmers field of Belagavi, Bagalkot, Gadag, and Vijayapur districts of northern Karnataka. No single management option was found effective across locations and time. An integrated *Striga* Control (ISC) approach including the combined use of cultural agronomic practices like deep ploughing, application of manure and fertilizer, trap cropping, germination stimulants, biological control contributed effective control of the parasitic weeds at places of study. This approach has provided a sustainable control over a wide range of bio-physical and socio-economic environments. ISC showed that these practices reduced *Striga* infestation and damage on farmers' fields and increased productivity by more than 20% over the control. The integrated approach was adopted by farmers' involvement or holistic *striga* management technologies in sugarcane.

Keywords: *Striga,* sugarcane, parasitic, sustainability.

INTRODUCTION

Karnataka State ranks 3rd in sugarcane production and 2nd with respect to sugar recovery in the country. The state is bestowed with favourable agro-climatic conditions for obtaining higher sugarcane yield and sugar recovery. Belagavi, Bagalkot and Vijayapur districts are the predominant sugarcane growing districts in Northern Karnataka and occupy major area under sugarcane. Mono-cropping of sugarcane for a prolonged period and taking ratoon crops in intensive cropping system and with concurrent moisture stress during the growth period favour the development of parasitic weed like striga in sugarcane (Hunsigi, 2004). In some pockets of sugarcane growing areas in northern Karnataka has noticed that during, last few years the incidence of parasitic weed in sugarcane was more severe in some of the areas belonging to the districts like Belagavi, Bagalkot, Gadag and Vijayapur. This parasitic weed has affected huge loss to the sugarcane cultivation and also sugar mills by way of substantial reduction in the yield and quality of the sugarcane (Hunsigi, 2004). In certain areas the menace is severe, forcing the growers to uproot the crop and clean the field. Sometimes farmers are completely removing the sugarcane and going for the alternative crops.

Although there are more than 35 species, only three species of *Striga* are recognized as economically important. *S. hermonthic* (Del.) Benth and *S. asiatica* (L.) Kuntze are the two most widespread and are the most economically significant species that parasitize on sugarcane. *Striga* causes damages in two ways first by competition for carbon and nutrients and second through physiological interactions and metabolic process (Kabambe, 2008).

The effect of *Striga* damage on sugarcane crop is caused reduction in yield. The extent of yield losses related to the incidence and severity of attack, the hosts susceptibility to *Striga* and environmental factors and the management level at which the crop is produced. It effects range from stunted growth through wilting

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yellowing and scorching of leaves to lower yields and death of affected plants. A report indicated that, sugarcane losses attributed to *Striga* are estimated at 22 to 27% (Gomez et al. 2008).

Although several management practices are available to combat the parasitic weed, there is a need for integrated approach to curtail the infestation of *striga* on sugarcane. Though there are some efforts made by the extension agencies of sugar factories and State Agricultural Universities to minimize the incidence.

However, these efforts were confined only to conducting the field days. Keeping the serious losses caused by *Striga* to sugarcane crop every year, an integrated approach of involving farmers in holistic *striga* management technologies in sugarcane was attempted in present study. The study was initiated by S. Nijalingappa Sugar Institute, Belagavi with objective of enhancing and sustaining the productivity of sugarcane by managing the parasitic weed striga.

MATERIALS AND METHOD

The field studies were conducted at S. Nijalingappa Sugar Institute Belagavi under Northern dry zone of Karnataka (Zone-3). Initially roving survey was conducted to study the effect of *Striga* on sugarcane at various districts of Belagavi (L1), Bagalkot (L2), Gadag (L3) and Vijayapur (L4). Approach was initiated by conducting an introductory farmers workshop followed by a meeting at the village level. Opinions of the farmers were collected via questionnaires consisting details of farmers, planting date and other parameters. A total of 100 farmers were selected from the above mentioned districts. Information on adoption of control measures expected yield, loss due to *Striga* was collected. In each field 5 spots were selected randomly for the purpose of computing average damage of *Striga* from the farmers. Observations were be made on percent infestation. Number of *Striga* plant / sq meter area.

$$\text{Per cent infestation} = \frac{\text{Number of infested plants}}{\text{Total number of plants}} \times 100$$

Survey format for sugarcane *Striga* : name of the farmer, village, taluk, area, size, source of irrigation, variety ,date of planting, date of harvesting, estimated yield and yield loss number of striga plants per plot.

The field studies were carried out in farmers' field with recommended package of practices with sugarcane variety Co 86032 with following treatments.

Cultural control method

The main strategy for control was to reduce the seed bank of *Striga* in the soil by stimulating the seeds to germinate in the absence of host plants. This was achieved by planting sorghum, a susceptible poaceous trap crop, which was deep ploughed using chisel plough/ sub soiler in summer few weeks after sowing before the weeds mature and set seed. Later after planting of sugarcane PSB inoculated trash mulching cum intercropping of sunhemp in alternate rows was taken.

Mechanical control method

Hand weeding was done thrice at 30,60,and 90 DAP inter cultivation with bullock drawn implements or power was operated with weeder twice at 45 and 60 DAP and removal of weeds within the row was by hand pulling.

Chemical method

Pre and post emergence herbicides Atrazine +2,4-D 1+1 kg per acre (50+50g per 15lt tank) was applied and 2,4-D was repeated after every 15 days after application and spraying was done using high pressure pump for effective application of herbicide.

Integrated striga control (ISC)

An integrated Striga management approach was adopted for reducing impact of striga at the farm level. Striga management practices combined with mechanical, cultural agronomic practices, herbicides, fertilization, inter cropping, and Bio-fertilization was done.

All these methods were compared with the farmers practice that were adopted in those particular areas for management of Striga.

RESULTS AND DISCUSSION

Effect of different methods of striga control on emergence and dry matter accumulation.

The number of striga per plot and their dry weight were recorded at 120 and 180 days after planting (DAP) (Table 1 and 2). In general, Integrated Striga Control (ISC) reduced the striga emergence (0.75) compared to other methods of striga control (Table 1 and 2). ISC suppressed the striga emergence compared to mechanical (11.36 per plot), cultural (9.01 per plot) and control (farmers practice plot) 26.30 per plot over the mean of four locations. The striga emergence was very low in ISC due to combined effect of the ISC which has suppressed the growth of striga. At 180 DAP the highest mean of the total dry biomass over the locations was recorded in farmers practice method with 26.30 gram per plot over the rest of the other methods. The mean of the lowest dry matter accumulation was recorded in ISC (1.43 gram per plot). There was no much difference in the dry matter accumulation and emergence of weed over the locations.

Table 1 : Effect of different methods if *striga* control on emergence of *striga* at 120 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	11.3	11.66	11.16	11.33	11.36
Cultural Method	9.0	9.00	8.86	9.17	9.01
Chemical Method	7.85	7.58	7.69	8.10	7.81
Integrated Striga Control (ISC) Method	1.00	0.66	0.33	1.00	0.75
Control (Farmer`s Practice)	21.66	24.85	30.15	28.54	26.30

Table 2 : Effect of different methods of *Striga* control on dry matter of *striga* (G/Plot) at 180 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	18.10	17.79	18.25	18.50	18.16
Cultural Method	14.21	13.89	13.00	14.17	13.82
Chemical Method	11.21	11.58	10.96	11.10	11.21
Integrated Striga Control (ISC) Method	1.75	1.66	1.32	1.00	1.43
Control (Farmer`s Practice)	40.34	37.81	39.53	28.54	36.56

Number of tillers

The observation on number of tillers were recorded at 180 DAP and 240 DAP the data revealed that the number of tillers were maximum at 180 DAP in the Integrated striga control method (126.18 per plot) followed by chemical (115.78 per plot). The lowest number of tillers per plot was recorded in mechanical (97.65 per plot) and farmers practice 66.30 per plot). There was no much difference between the locations in respect to number of tillers per plot. Similar trend was also noticed during the tiller count per plot at 240 DAP (Table 3 and 4).

Table 3 : Effect of different methods of *Striga* control on number of tillers per plot at 180 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	98.77	96.11	98.58	97.15	97.65
Cultural Method	113.67	110.43	107.18	112.07	110.84
Chemical Method	117.20	116.90	113.78	115.23	115.78
Integrated Striga Control (ISC) Method	125.17	120.33	127.97	131.25	126.18
Control (Farmer`s Practice)	70.77	68.77	64.97	60.67	66.30

Table 4 : Effect of different methods of *Striga* control on number of tillers per plot at 240 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	88.47	86.14	88.58	87.15	87.59
Cultural Method	103.67	100.43	97.18	102.06	100.84
Chemical Method	107.24	106.97	103.87	105.31	105.85
Integrated Striga Control (ISC) Method	115.18	110.23	117.96	121.52	116.22
Control(Farmer`s Practice)	65.77	66.77	60.97	55.67	62.30

Effect of different methods of Striga control on cane height (cm)

The different methods of striga control influenced the growth of the cane which was recorded at 360 days after planting the highest cane height was recorded in ISC method with 256 cm and the lowest height of cane was recorded in the farmers practice181 cm which was due to suppressed effect of the striga (Table 5).

Table 5 : Effect of different methods of *Striga* control on height of cane (cm) at 360 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	220	225	230	221	224
Cultural Method	229	238	240	245	238
Chemical Method	238	242	246	234	240
Integrated Striga Control (ISC) Method	262	258	255	249	256
Control (Farmer`s Practice)	200	180	175	168	181

Number of millable cane (NMC) and cane yield as influenced by the different methods of Striga control at 360 DAP.

The highest number of millable cane were produced in integrated striga control method with 110.47 number of tillers per ha followed by the Chemical method 99.85 number of tillers per ha. The lowest number of tillers were recorded over the different location was recorded in framers practice method with 58.30 lakh tillers per ha (Table 6 and 7). The cane yield was also influenced by the different methods of striga control the highest cane yield was recorded in ISC with 121.25 tons per ha over the different locations this was followed by cultural method and chemical method with 116 and 115 tons per ha respectively (Table 7). The lowest yield was recorded in farmers practice method and mechanical method 58.30 and 80.84 tons per ha, respectively. This is due to sever

Table 6 : Effect of different methods of *Striga* control ’000/ha at 360 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	220	225	230	221	224
Cultural Method	229	238	240	245	238
Chemical Method	238	242	246	234	240
Integrated Striga Control (ISC) Method	262	258	255	249	256
Control (Farmer`s Practice)	200	180	175	168	181

effect of striga which has suppressed the growth of sugarcane during the initial phase of the crop. The suppression of striga is mainly known to be due to depletion of strigolactones in the rhizospheres of the sugarcane host plant. Strigolactones are siganalling molecules that play a vital role as germination stimulants of the parasitic weed striga and the stimulants are exuded in to the rhizosphere by the roots of the sugar cane plant (Franke, 2006) in the present study at different locations with various methods of striga control. ISC method have significantly reduced the emergence and biomass of striga compared to routine management practices followed by farmers. This can be attributed to the fact that the strigolactones are converted in to another compound in the rhizosphere due to the frequent disturbance in the rhizosphere by ISC which has reduced the availability of strigolactones for the emergence of striga (Walter et al. 2011). Integrated chemical method with bio fertilization has suppressed the striga emergence indicating the compatibility of bio agents with herbicides. In a similar study with herbicides alone, Kabambe et al. (2008) evaluated the effects of seed treatment with Imazethapyr significantly suppressed the striga emergence. The results of the present study have indicated that ISC in sugarcane influenced the growth attributes such as height, number of tillers, millable cane over the other methods and farmers practice. Deep ploughing and timely and frequently application of nutrients ascribed to positive interactions between the sugarcane plant and balanced mobilization of nutrients like P and K to the host crop and also plant growth promotion could be associated with early suppression of striga. Integrated Striga control (ISC) that can provide sustainable control over a wide range of bio-physical and socio-economic environments found that ISC that combined rotation of resistant crop, trap crops and fertilizer application reduced the Striga soil seed bank and increased crop productivity by 20% (Figure 1). The ISC has reduced the excessive use of chemicals that lead to the microbial

Table 7 : Effect of different methods of *Striga* control on cane yield (t/ha) at 360 DAP

Methods	Locations				Mean
	L1	L2	L3	L4	
Mechanical Method	118	115	112	108	113.25
Cultural Method	120	118	116	110	116.00
Chemical Method	117	116	118	112	115.75
Integrated Striga Control (ISC) Method	125	121	120	119	121.25
Control (Farmer`s Practice)	99.1	98.77	96.97	99.67	98.62

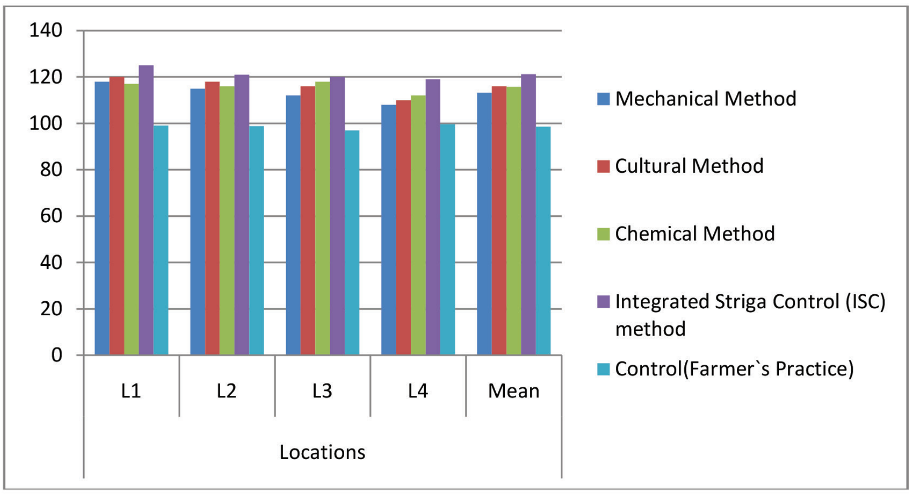

Figure 1 : Comparision of yield of sugarcane (t/ha) under different methods of *Striga* control

imbalance,environmental pollution and health hazards. Therefore, integration of the all the methods with admissible levels of chemicals could help in ecological balance and augmenting sugarcane growth.

ACKNOWLEDGEMENT

Authors are grateful to Chairman and Governing council members of S. Nijalingappa Sugar Institute and participating farmers from different districts for their support and encouragement in carrying out the research work.

REFERENCES

De Groote H, Wangare L, Kanampiu F, Odendo M and Friesen D. (2005) Potential markets for herbicide resistant maize seed for Striga in Africa. Back ground paper for a poster presented at the European Asso. of Agric Economists congress, Copenhagen, Denmark: 23-27 August, 2005.

Franke AC, Ellis-Jones J, Tarawali G, Schulz S, Hussaini MA, Kurch I, White R, Chikoye D, Douthwaite B, Oyewole BD and Olanrewaju AS. (2006) Evaluating and scaling-up integrated Strigahermonthica control technologies among farmers in northern Nigeria. *Crop Protection,* 25:868-878.

Gebisa E and Gressel J (2007). (Eds). Intergrating new technologies for striga control towards ending the witch – Hunt, World Scientific Publishing Co. Pte. Ltd., Singapore: 345.

Gomez – Roldan V, Fermas S, Brewer P.B., Puech-pages V, Dun EA, Pillot JP, Letisse F, Matusova R, Danoun S, Portias JC, Bouwmeester H, Becard G, Beveridge CA, Rameau C and Rochange SF (2008) Strigolactone inhibition of shoot branching. *Nature,* 455:180-194.

Hunsigi G. (2000). Sugarcane : In Agriculture and Industry. Prism Publications, ISBN: 978-8172861490.

Kabambe VH, Kauwa AE (2008), Role of herbicides and fertilizer application in integrated nagement of striaga. African J Agric. *Res.,*3(2): 140-146.

Walter M, Floss Dand Strack D (2011). Apocarotenoids: harmones, and aroma volatiles. *Planta* 23: 21-27.