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RESEARCH REPORT

A WEED SURVEY OF ARABLE LANDS OF THE SMALL-SCALE FARMING SECTOR OF ZIMBABWE

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There has been no national weed survey of weeds of arable lands in the small-scale non-commercial (SSNC) farming sector of Zimbabwe. All previous surveys done in the country covered the large-scale commercial (LSC) farming sector (Rattray and Wild, 1955; Soane and Waister, 1963; Thomas, 1970; Budd, 1975; Chivinge, 1983). However, periodic weed surveys are necessary as weed populations, compositions and intensity of infestations change with climatic variations and agricultural practices (Chancellor and Froud-Williams, 1984). As there has been no previous weed survey it was decided to conduct a national weed survey of the SSNC farming sector with the following objectives:

(i) to find out which weeds are the most aggressive and difficult to control in the different administrative and ecological regions;
(ii) to determine if there are any differences in the weed spectra in the five ecological regions;
(iii) to find out which weeds need urgent detailed studies; and
(iv) to establish a base for future weed surveys at national, provincial, district and regional level so as to monitor weed pressure or population changes every few years.

MATERIALS AND METHODS

The survey was done in two stages. During the first stage a total of 600 questionnaires were sent to the Department of Agricultural, Technical and Extension Services (Agritex) and agro-chemical personnel from September 1983. The same exercise was repeated during 1983 to 1984. This period was chosen so as to cover both the summer and winter crop-growing seasons. The technical officers were asked to report on weeds specifically found in the SSNC farming areas of that part of the province in which they were working. Those completing the questionnaires were asked to list the weed species on the basis of aggressiveness of weeds and the difficulty in controlling them, noting any new weeds that had become problematic in the past five years.

Aggressiveness refers to fast and vigorous growth in the early stages of the weed so as to adversely affect the growth and development of the crop in its young stages. Difficult to control refers to situations in which weed control by hand pulling, hoeing or use of ox-drawn cultivators is not easily accomplished or to weeds which quickly produced subsequent generations soon after the removal of the same weed by the above-mentioned methods.

The second stage was done from 1983 to 1985 covering both the summer and

winter crop-growing seasons. This stage of the survey was considered necessary to verify the information from the first stage of the survey. The period 1983 to 1985 covered relatively dry and wet years. During this period the author went to two areas in each province and recorded weeds found in the fields.

For the selection of farmers whose fields were sampled, stratified random sampling was used. Agritex officers were asked to divide each province into eight equal parts by area. Each area was further sub-divided into sixteen smaller areas. Of the sixteen smaller portions each was sub-divided again into sixty-four villages. From each village the names of one hundred above-average and one hundred below-average farmers were submitted. The eight and sixteen smaller areas were numbered. By use of random number tables the first number to appear was chosen. The same process was repeated for the sixty-four villages. Then ten farmers were randomly chosen from the one hundred above-average and another ten chosen from the below-average farmers. Their fields of maize, cotton, sorghum and pearl millet were sampled.

For the actual sampling spot of the field systematic sampling was used. The land was divided diagonally and sampling was done every 20 metres following the diagonal lines. A total of six quadrats were taken in each field and the quadrats were 1m × 1m. Weeds in each quadrat were identified and classified as 'aggressive' or 'difficult to control'.

Each area was visited eight times in the period 1983/4–1984/5. The first visit was at the beginning of each growing season and the second at the end of each season. The author also had personal interviews with some of the farmers whose fields were visited.

RESULTS

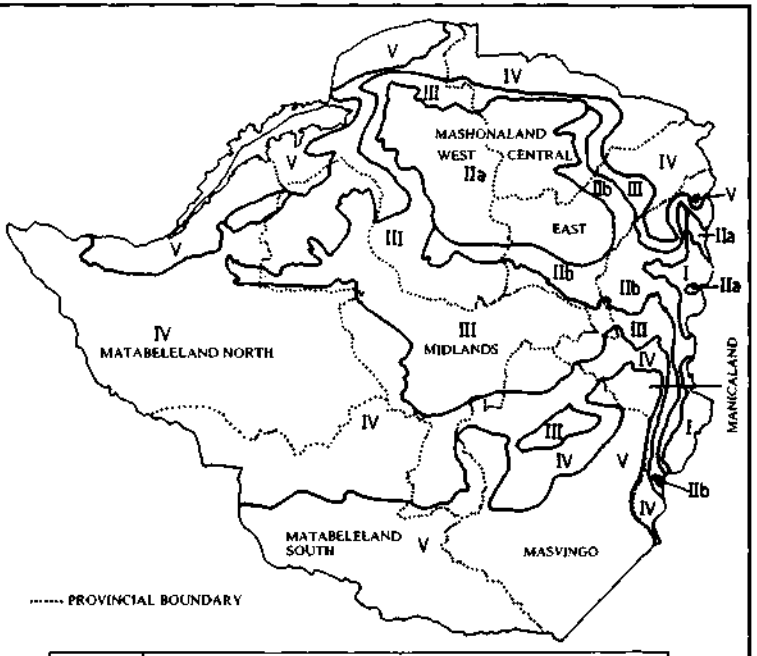
The administrative provinces and ecological regions are shown in Figure 1. From information from the survey the weeds were grouped into 'aggressive' and 'difficult to control' weeds on a provincial basis. Weeds were listed in order of frequency of occurrence.

The most aggressive weeds

Acanthospermum hispidum was the most aggressive weed in six out of the eight provinces (Table I). The same weed was second in Mashonaland West and third in Mashonaland East. During the field survey this weed was found to infest most fields irrespective of crop or soil type, although it was more associated with sandy, poor soils. In both Mashonaland East and Mashonaland West *Eleusine indica* was the most aggressive weed. In lands which had been fertilized with either cattle manure or inorganic fertilizers the weed grew very fast to the extent that most cereal crops were easily choked, though all types suffered when infestations were heavy. In Manicaland and Masvingo *E. indica* was the second most aggressive weed.

Other weeds which were particularly aggressive in all the provinces were *Commelina benghalensis*, *Striga asiatica*, *Striga* spp., *Tagetes minuta*, *Bidens pilosa*, *Rottboellia cochinchinensis*, *Amaranthus hybridus*, *Cynodon dactylon*,

Figure 1: PROVINCIAL BOUNDARIES, ECOLOGICAL REGIONS AND FARMING AREAS OF ZIMBABWE



	Related Farming System
I	1 700 m above sea level. Rainfall above 1 000 mm p.a. with precipitation every month. Diversified farming
IIa	Rainfall 750–1 000 mm. Intensive crop and livestock farming
IIb	Rainfall 750–1 000 mm. Intensive crop and animal production. Occurrence of dry spells or shorter rainy season
III	Rainfall 650–800 mm. Semi-intensive farming with mid-season drought
IV	Rainfall 450–800 mm. Periodic droughts and severe mid-season droughts
V	Rainfall below 560 mm. Very erratic even for drought resistant crops but good for livestock.

Table I

THE MOST AGGRESSIVE WEEDS IN EACH PROVINCE*

Manicaland		*Mashonaland Central*		*Mashonaland East*		*Mashonaland West*	
Acanthospermum hispidum	18	*Acanthospermum hispidum*	29	*Eleusine indica*	25	*Eleusine indica*	24
Eleusine indica	11	*Striga asiatica*	27	*Commelina bengalensis*	20	*Acanthospermum hispidum*	22
Bidens pilosa	10	*Striga* spp.	21	*Acanthospermum hispidum*	18	*Commelina benghalensis*	18
Commelina benghalensis	8	*Amaranthus hybridus*	18	*Richardia scabra*	17	*Richardia scabra*	15
Cynodon dactylon	8	*Tagetes minuta*	15	*Striga asiatica*	15	*Ipomoea plebia*	12
Amaranthus hybridus	5	*Eleusine indica*	13	*Striga* spp.	15	*Cyperus esculentus*	11
Striga asiatica	5	*Commelina benghalensis*	13	*Rottboellia cochinchinensis*	6	*Tagetes minuta*	6
Striga spp.	5	*Rhynchelytrum repens*	12	*Tagetes minuta*	6	*Amaranthus hybridus*	5
Tagetes minuta	4	*Cyperus esculentus*	9	*Amaranthus hybridus*	4	*Rottboellia cochinchinensis*	5
Eragrostis aspera	3	*Panicum maximum*	9	*Nicandra physalodes*	4	*Striga asiatica*	5
Nicandra physalodes	3	*Nicandra physalodes*	8	*Cyperus esculentus*	3	*Striga* spp.	5
Cleome monophylla	3	*Rottboellia conchinchinensis*	8	*Bidens pilosa*	2	*Cyperus rotundus*	4
Richardia scabra	3	*Bidens pilosa*	4	*Boerhavia diffusa*	2	*Nicandra physalodes*	4
Ceratotheca sesamoides	3	*Cyperus rotundus*	4	*Galinsoga parviflora*	2	*Portulaca oleracea*	4
Cyperus esculentus	2	*Eragrostis aspera*	3	*Rhynchelytrum repens*	2	*Physallis angulata*	4
Cyperus rotundus	2	*Hibiscus meeusi*	3	*Sida cordifolia*	2	*Urochloa panicoides*	3
Hibisus meeusei	2	*Galinsoga parviflora*	3	*Urochloa panicoides*	2	*Eragrostis aspera*	3
Vernonia cinerea	2	*Celosia trigyna*	2	*Vernonia cinerea*	2	*Bidens pilosa*	3
Vernonia poskeana	2	*Conyza floribunda*	2	*Vernonia poskeana*	2	*Celosia trigyna*	2
Urochloa panicoides	2	*Donyza sumatrensis*	2	*Hibiscus trionum*	2	*Euphorbia heterophylla*	2
Ocimum canum	2	*Xanthium strumarium*	2	*Hibiscus meeusei*	1	*Ocimum canum*	2
Euphorbia heterophylla	2	*Digitaria* spp.	2	*Ocimum canum*	1	*Sida alba*	2
Gisekia africana	2	*Ocimum canum*	2	*Digitaria* spp.	1	*Oxygonum sinuatum*	1
Crotolaria laburnifolia	2	*Sida alba*	2	*Trichodesma zeylanicum*	1		
		Trichodesma zeylanicum	1	*Crotolaria laburnifolia*	1		
		Gisekia africana	1	*Gisekia africana*	1		
		Aergemone mexicana	1	*Aergemone mexicana*	1		
				Oxygonum sinuatum	1		

Midlands		*Matabeleland North and South*		*Masvingo*	
Acanthospermum hispidum	29	*Acanthospermum hispidum*	21	*Acanthospermum hispidum*	25
Striga asiatica	24	*Amaranthus hybridus*	18	*Eleusine indica*	22
Striga spp.	22	*Bidens pilosa*	15	*Striga asiatica*	20
Eleusine indica	21	*Commelina benghalensis*	13	*Striga* spp.	18
Commelina benghalensis	16	*Cyperus esculentus*	12	*Commelina benghalensis*	17
Tagetes minuta	11	*Tagetes minuta*	12	*Ipomoea plebia*	10
Amaranthus hybridus	8	*Eleusine indica*	11	*Ipomoea* spp.	8
Cyperus esculentus	8	*Portulaca oleracea*	11	*Portulaca oleracea*	8
Bidens pilosa	5	*Striga asiatica*	6	*Bidens pilosa*	7
Nicandra physalodes	4	*Striga* spp.	6	*Tagetes minuta*	7
Cyperus rotundus	4	*Nicandra physalodes*	5	*Cyperus rotundus*	5
Galinsoga parviflora	2	*Rottboellia cochinchinensis*	5	*Boerhavia diffusa*	5
Portulaca oleracea	2	*Cyperus rotundus*	4	*Tribulus terrestris*	4
Rhynchelitrum repens	2	*Galinsoga parviflora*	3	*Amaranthus hybridus*	4
Rottboellia conchinchinensis	1	*Ocimum canum*	3	*Cleome monophylla*	4
Ipomoea plebia	1	*Jacquemontia tamnifolia*	1	*Celosia trigyna*	4
Aergemone mexicana	1			*Hibiscus meeusei*	4
Hibiscus meeusei	1			*Gisekia africana*	3
Gisekia africana	1			*Oxalis latifolia*	3
Oxygonum sinuatum	1			*Ceratotheca sesmoides*	2
Eragrostis aspera	1			*Commelina forskaolaei*	1
				Eragrostis aspera	1

* The most aggressive weeds are at the top of the list and the least aggressive at the bottom of each list. The numbers indicate the number of times the weed was reported and observed to be an aggressive weed.

Cyperus rotundus, *Cyperus esculentus*, *Richardia scabra* and *Ipomoea plebeia*. However, the aggressiveness of each weed species varied slightly from one province to another. *B. pilosa* was the third most aggressive weed in Manicaland, Matabeleland North and Matabeleland South. This weed was found growing luxuriantly wherever there were heavy infestations. Well-fertilized fields seemed to encourage the weed to grow well, even under heavy shading from crops such as maize and cotton. *R. scabra* was the fourth most aggressive weed in Mashonaland East and Mashonaland West. Information gathered during the field survey revealed that this weed has been on the increase in all the provinces since about ten years ago.

C. esculentus and *I. plebeia* were particularly aggressive in Mashonaland West. Farmers interviewed revealed that the main method of controlling *C. esculentus* was hoeing which only removed the shoot portion. This leaves the tuber underground which would produce another shoot. In fact, removal of one shoot stimulates dormant buds in the tuber, resulting in more shoots sprouting. *I. plebeia* and other *Ipomoea* species, were a big problem in Masvingo where they were reported and observed to climb on almost every other plant, crop or weed growing close to them. *Ipomoea* spp. were not easily distinguished from many crops, particularly broadleaf crops in the early stages, because they were found to be growing under heavy shading from crops. During that stage they formed long, thin vines which entangled the crop and would only emerge above the crop canopy towards flowering.

In Manicaland *C. dactylon* was the fifth most aggressive weed. However, in all other provinces its frequency was quite low. Most farmers interviewed in other provinces reported that once the land is ploughed and the weed is exposed to the dry weather it easily succumbs to the hot temperatures. Manicaland is a rather wet province compared to all the others. Another weed which was rather restricted to one province was *R. cochinchinensis*. It was reported to be among the most aggressive weeds in Mashonaland Central but was less aggressive in other provinces and was not even listed in Masvingo and Manicaland. In all areas where it was observed during the field survey it was found only in heavy soils and mostly associated with the maize crop. The growth habit and appearance of these two plants are so similar as to make distinction very difficult, particularly during the first few weeks of growth.

S. asiatica and other *Striga* species were reported and found to infest maize, sorghum and pearl millet in all the eight provinces. This weed was the second most aggressive weed in Mashonaland Central and the third most aggressive weed in the Midlands and Masvingo. Field observations revealed severe infestations and damage to late planted and poorly fertilized crops. Many plants wilted under adequate moisture even before the *Striga* emerged above ground. *C. benghalensis* was the second most aggressive weed in Mashonaland East and the third in Mashonaland West. In the other six remaining provinces, it had more or less the same frequency. This weed was found growing in all soil types and altitudes and seemed to tolerate shading from most crops.

Of the most aggressive weeds *A. hybridus* was the second most aggressive weed in both provinces of Matabeleland and the fourth most aggressive weed in Mashonaland Central. Least aggressive weeds varied considerably from one province to another with only *Oxygonum sinuatum* being the least aggressive in

more than one province. Consequently, these weeds will not be discussed any further.

The most difficult weeds to control

The most difficult weed to control in all the provinces, except in Mashonaland Central, was *A. hispidum* (Table II). Most farmers who were interviewed reported that the weed grew in dense stands and subsequent generations always came up soon after removal of one generation. In Mashonaland Central *C. benghalensis* was the most difficult weed to control, and it was the third most difficult weed to control in Mashonaland East. Other weeds with high frequencies included *E. indica*, *S. asiatica*, *Striga* spp., *B. pilosa*, *C. esculentus*, *C. rotundus*, *A. hybridus*, *R. cochinchinensis* and *T. minuta*. *E. indica* was the second most difficult weed to control in Manicaland, Mashonaland East and Masvingo.

S. asiatica and *Striga* spp. were considered difficult weeds to control in all the other provinces except in Mashonaland West. *S. asiatica* was the third most difficult weed to control in Manicaland and Masvingo. Large patches were found particularly in Masvingo with the heaviest infestations being on pearl millet. The only province where *R. cochinchinensis* was considered a difficult weed to control was Mashonaland East. During the field survey it was observed that this weed was restricted to heavy red and black soils only. In cases when the weed was left in the field and had attained a height of over 30 cm, it became very difficult to remove it by hand pulling, hoeing or use of ox-drawn cultivators, as the weed had developed strong brace roots. This weed was not even mentioned by the respondents in Manicaland and Masvingo provinces.

C. rotundus and *C. esculentus* were the only two sedges reported and observed to be difficult weeds to control; *C. esculentus* was the third most difficult weed to control in Mashonaland West and the fourth in Mashonaland East. This weed was mostly found in lighter soils. *T. minuta* was more of a problem in the Midlands while *A. hybridus* was difficult to control in Masvingo. The least difficult weeds to control were different in each province with the exception of *Hibiscus meeusei* which was at the bottom of the list in both Manicaland and Masvingo.

DISCUSSION

The survey revealed that *R. scabra*, *Richardia brasiliensis* and *Trichodesma zeylanicum* were becoming problem weeds countrywide. *T. zeylanicum* germinates towards the end of the summer season when most crops are almost mature. Most farmers interviewed did not consider it necessary to weed it out as they were of the opinion that it had no chance to compete with the crop. Both species of *Richardia* were observed and reported to germinate throughout the summer and consequently those plants which grow towards the end of the summer season are never removed. *Tribulis terrestris* was observed and reported only in Masvingo where it is on the increase.

Another observation was that over 40 per cent of the farmers' fields visited had weeds and crops of the same size before the first weeding was done. This is too late to remove weeds as the detrimental effects of weeds on crop growth and final yield would have already occurred. Most farmers tended not to remove weeds

Table II

THE MOST DIFFICULT WEEDS TO CONTROL IN EACH PROVINCE*

Manicaland		*Mashonaland Central*		*Mashonaland East*		*Mashonaland West*	
Acanthospermum hispidum	18	*Commelina benghalensis*	19	*Acanthospermum hispidum*	15	*Acanthospermum hispidum*	14
Eleusine indica	12	*Acanthospermum hispidum*	18	*Eleusine indica*	12	*Commeline benghalensis*	10
Striga asiatica	10	*Eleusine indica*	17	*Commelina benghalensis*	10	*Cyperus esculentus*	9
Striga spp.	10	*Striga asiatica*	12	*Cyperus esculentus*	8	*Cyperus rotundus*	9
Commelina benghalensis	8	*Striga* spp.	11	*Rottboellia cochinchinensis*	8	*Eleusine indica*	8
Amaranthus hybridus	6	*Cyperus esculentus*	9	*Richardia scabra*	7	*Amaranthus hybridus*	5
Amaranthus spp.	6	*Richardia scabra*	8	*Striga* spp.	7	*Rottboellia conchinchinensis*	5
Cynodon dactylon	4	*Portulaca oleracea*	3	*Striga asiatica*	6	*Tagetes minuta*	5
Cleome monophylla	4	*Cyperus rotundus*	3	*Amaranthus hybridus*	3	*Galinsoga parviflora*	3
Bidens pilosa	3	*Amaranthus hybridus*	3	*Galinsoga parviflora*	2	*Euphorbia heterophylla*	3
Richardia scabra	3	*Panicum maximum*	2	*Bidens pilosa*	2	*Panicum maximum*	3
Nicandra physalodes	3	*Rhynchelytrum repens*	2	*Urochloa panicoides*	2	*Ipomoea plebeia*	2
Euphorbia heterophylla	2	*Tagetes minuta*	2	*Digitaria* spp.	2	*Rhynchelytrum repens*	2
Cyperus esculentus	2	*Rottboellia cochinchinensis*	2	*Eragrostis aspera*	1	*Urochloa panicoides*	2
Urochloa panicoides	1	*Nicandra physalodes*	1			*Bidens pilosa*	2
Hibiscus meeusei	1	*Conyza floribunda*	1				
		Digitaria spp.	1				
		Xanthium strumarium	1				

Midlands		*Matabeleland North and South*		*Masvingo*	
Acanthospermum hispidum	25	*Acanthospermum hispidum*	18	*Acanthospermum hispidum*	21
Striga asiatica	23	*Bidens pilosa*	14	*Eleusine indica*	20
Striga spp.	22	*Eleusine indica*	13	*Striga asiatica*	18
Eleusine indica	21	*Commelina benghalensis*	12	*Striga* spp.	18
Commeline benghalensis	20	*Cyperus esculentus*	10	*Commelina benghalensis*	16
Tagetes minuta	11	*Tagetes minuta*	7	*Amaranthus hybridus*	10
Cyperus esculentus	10	*Portulaca oleracea*	5	*Richardia scabra*	8
Portulaca oleracea	5	*Amaranthus hybridus*	4	*Bidens pilosa*	8
Amaranthus hybridus	5	*Euphorbia heterophylla*	4	*Tagetes minuta*	7
Bidens pilosa	5	*Nicandra physalodes*	3	*Cyperus esculentus*	7
Cyperus rotundus	3	*Rottboellia cochinchinensis*	2	*Cyperus rotundus*	6
Cynodon dactylon	3	*Urochloa panicoides*	2	*Euphorbia heterophylla*	5
Rhynchelytrum repens	3	*Cynodon dactylon*	1	*Tribulus terrestris*	2
Urochloa panicoides	1			*Hibiscus meeusei*	2
Galinsoga parviflora	1				
Nicandra physalodes	1				

* The most difficult weeds to control are at the top of the list and the least difficult at the bottom of each list. The numbers indicate the number of times when the weed was reported and observed to be a difficult weed to control.

once their crops had reached the flowering stage. The only exception was with the cotton crop where weeds would down-grade the crop if the lint was contaminated with trash from weeds.

Of the thirteen most aggressive and difficult to control weeds, eight were broadleaf and five were narrowleaf (Table III). From the five narrowleaf weeds three were grasses and two were sedges.

Table III

THE THIRTEEN MOST AGGRESSIVE AND DIFFICULT WEEDS TO CONTROL, CLASSIFIED ON FAMILY AND LEAF BASIS

Weed	*Family*	*Narrowleaf*	*Broadleaf*
Acanthospermum hispidum	*Asteraceae*	No	Yes
Amaranthus hybridus	*Amaranthaceae*	No	Yes
Bidens pilosa	*Asteraceae*	No	Yes
Commelina benghalensis	*Commelinaceae*	No	Yes
Cynodon dactylon	*Poaceae*	Yes	No
Cyperus esculentus	*Cyperaceae*	Yes	No
Cyperus rotundus	*Cyperaceae*	Yes	No
Eleusine indica	*Poaceae*	Yes	No
Ipomoea plebeia	*Convolvulaceae*	No	Yes
Richardia scabra	*Rubiaceae*	No	Yes
Rottboellia cochinchinensis	*Poaceae*	Yes	No
Striga asiatica	*Scophulariaceae*	No	Yes
Tagetes minuta	*Asteraceae*	No	Yes

During the field survey it was noticed that most areas in the SSNC farming sector had sandy soils associated with *A. hispidum*. This observation agrees with Thomas (1970) and Drummond (1984). The weed was observed to have greater plasticity, i.e. it grew up to about 1 m tall, branched profusely and produced many seeds in moist, fertile soils, and in relatively dry, less fertile soils it grew to less than 30 cm tall and yet still produced at least small quantities of seeds. It spread easily by the attachment of its barbs to human clothes or animal fur (Drummond, 1984). This is probably why it has been found in all the eight provinces and all five regions of Zimbabwe. Although there have been no competition studies done on this weed, it does not seem to be competitive with most crops and is easily shaded in tall crops such as maize and cotton.

A. hispidum grew on almost all soil types and produced new generations irregularly. This is probably why most farmers regarded it as the most aggressive and difficult weed to control.

Thomas (1970), Budd (1975) and Chivinge (1983) reported *A. hispidum* to be among the top most aggressive and difficult weeds to control in the LSC farming sector. This clearly shows that this weed is a problem in all the arable

farming sectors of Zimbabwe, the problem being probably more pronounced in light soils.

E. indica produces numerous small seeds which germinate quite early in the crop-growing season and plants have a vigorous and extensive root system (Holm *et al.*, 1977). Field observation during the survey revealed that once the weed was more than one and a half months old from the time of emergence, it became very difficult to remove manually or mechanically. It is, therefore, not surprising to find this weed among the top most aggressive and difficult weeds to control in most provinces and ecological regions. Budd (1975) found it to be the most aggressive weed and the second most difficult weed to control in the LSC farming sector. This shows that *E. indica* grows in all ecological regions and soil types found in Zimbabwe. Consequently it is a problem in all the arable farming sectors of Zimbabwe.

C. benghalensis produces both aerial and subterranean seeds and also reproduces vegetatively. If the weed is removed by hand or mechanically, stems break off and root at the nodes, producing new plants. Thus, weeding may indirectly multiply the plant. Budd (1975) and Chivinge (1983) found *C. benghalensis* to be among the top seven most aggressive weeds in the LSC farming sector. Field observations by the author revealed that if *C. benghalensis* was allowed to grow in fertilized soils it grew quickly and luxuriantly and easily out-grew the crop plants. Control at that stage would be difficult except probably by the use of chemicals. This may explain why respondents reported it among the most aggressive and difficult weeds to control.

Other aggressive weeds such as *S. asiatica*, *Striga* spp., *A. hybridus*, *T. minuta*, *B. pilosa* and *R. cochinchinensis* are allowed to produce seed by the farmers as most SSNC farmers do not remove weeds once their crops have passed the flowering stage. The result is that these weeds come up in larger numbers in the subsequent seasons, as more seeds will have been added to those already in the seed bank. If more seed production is coupled with weed seed dormancy then the problem is worsened. For example, *Striga* spp. produces 400–500 seeds per capsule and seeds remain viable for 15–20 years (Ramaiah *et al.*, 1983).

While *Striga* spp. were among the top most aggressive and difficult weeds to control in the SSNC farming sector, both Thomas (1970) and Budd (1975) do not even mention them in the LSC farming sector surveys. This clearly shows a difference in crop and weed management systems in the two farming sectors. The fact that *Striga* spp. were more troublesome only in certain provinces is a reflection of the extent to which they grow maize, pearl millet and sorghum crops. The Midlands, Masvingo and Mashonaland East had certain areas which grew large proportions of these crops. Sorghum and pearl millet were not fertilized with inorganic fertilizers which reduce *Striga* infestations (Drummond, 1984). *Striga* spp. were found growing in patches, and the plants were short and thin. They only became conspicuous after flowering. This makes their control before flowering difficult.

Budd (1975) and Chivinge (1983) reported *R. cochinchinensis* to be the second most aggressive and the second most difficult weed to control in the LSC farming sector. However, in this survey it was a problem only in Mashonaland East. The main reason why it is not a big problem in the SSNC farming sector is that it grows well in heavy soils (Thomas, 1970). There are less heavy soils in the

SSNC and more in the LSC farming sector. The fact that it was not even mentioned in Masvingo and Manicaland is because of unfavourable low rainfall and low temperatures, respectively, as suggested by Thomas (1970). Weed management throughout the whole year, rather than weed control during the first half of the summer, would reduce the numbers of these weeds. The fact that the most aggressive weeds are similar to a certain extent in all the provinces and ecological regions suggests that the farming practices used by the SSNC farming sector are not very different, irrespective of the soil type, amount of rainfall or other climatic factors. Early germination and plasticity are attributes of highly competitive plants (Aldrich, 1984) and these characteristics are found in most of the weeds listed as aggressive and difficult to control in this survey. Some of these weeds, such as *A. hispidum*, have irregular germination which makes control difficult because they germinate throughout the whole year. Most SSNC farmers cannot weed when it is too wet because they either hand-hoe or cultivate with ox-drawn implements. The result is weeds with big root systems which are difficult to remove by these methods of weeding.

CONCLUSIONS

The most aggressive and difficult-to-control weeds in the SSNC farming sector have been identified in all the administrative and ecological regions. The weeds were common across all the ecological regions and were mostly broadleaf weeds, three grasses and two sedges. Weeds which have started increasing over the past few years are now known and a base for future weed surveys has been established. It should be appreciated that some weeds might be very aggressive or difficult to control only in a particular limited locality.

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References

ALDRICH, R. J. 1984 *Weed-Crop Ecology: Principles in Weed Management* (North Scituate MA, Breton Publishers).

BUDD, G. D. 1975 'A second survey of arable lands of Rhodesia', *Rhodesia Agricultural Journal*, LXXIII, 159–60.

CHANCELLOR, R. J. and FROUD-WILLIAMS, R. J. 1984 'A second survey of cereal weeds in central southern England', *Weed Research*, LXXIV, 29–36.

CHIVINGE, O. A. 1983 'A weed survey of arable lands in the commercial sector of Zimbabwe', *Zimbabwe Agricultural Journal*, LXXX, 39–41.

DRUMMOND R. B. 1984 *Arable Weeds of Zimbabwe: A Guide to the Recognition of the More Important Weeds of Crops* (Harare, Agricultural Research Trust of Zimbabwe).

HOLM, L. G., PLUCKNETT, D. L., PANCHO, J. V. and HERBERGER, J. P. 1977 *The World's Worst Weeds: Distribution and Biology* (Honolulu, Hawaii Univ. Press).

RAMAIAH, K. V., PARKER, C., RAO VASUDEVA, M. J. and MUSSELMAN, L. J. 1983 *Striga Identification and Control Handbook* (Hyderabad, International Crop Research Institute for the Semi-Arid Tropics).

RATTRAY, J. M. and WILD, W. 1955 'Report on the vegetation of the alluvial basins of the Sabi Valley and adjacent areas', *Rhodesia Agricultural Journal*, LII, 484–501.

SOANE, C. M. and WAISTER, P. D. 1963 'A note on weeds of irrigated lands in the Sabi valley', *Journal of Agricultural Research*, I, 47–52.

THOMAS, P. E. L. 1970 'A survey of arable lands of Rhodesia', *Rhodesia Agricultural Journal*, LXVII, 34–5.