

Integrated pest management as part of a cleaner textile production strategy for cotton in South Africa

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ABSTRACT

Integrated Pest Management (IPM) is the main initiative of the Cleaner Textile Project on the cotton production side. The project is funded by DANIDA, the Danish International Development Assistance and carried out under the auspices of DARUDEC, a Danish consultancy agency. In order to reduce the negative environmental impact of cotton in the cotton-growing phase, initiatives that mainly involve the training of farmers have been started and will be continued. The training is aimed at emerging farmers and at commercial cotton farmers, to implement Integrated Pest Management principles and best management practices in order to promote cleaner production strategies. The activities of the project with regards to IPM, and the dissemination strategies involved are discussed.

Introduction

The Cleaner Textile Production (CTP) project is supported by Cotton SA in Pretoria (SA) and has been ongoing for the past 2.5 years. Other important role-players include the Pollution Research Group, University of Natal, the Water Research Council, the Department of Agriculture, the South African Cotton Producers Organization (SACPO), to mention only a few. The main activity of the cotton-growing phase of the Cleaner Textile Production Project is the training of people to perform scouting, either for themselves, or for farmers. Several training sessions have been held during the past two years, and experience has shown that the training is most effective if it is directed towards the small-scale farmer. The CTP has been initiated during the cotton season of 2000, and training of farmers in Integrated Pest Management (IPM) principles has been ongoing. The concept of IPM is introduced to the farmer through a series of mechanisms that make it easy and desirable to implement. Cleaner Production is a cost-effective way to farm "smartly", and during these training sessions, the trainee is introduced to adapt to a moderate, careful approach towards hazardous chemicals. All the factors that influence the decision for chemical control of cotton pests are analyzed, and the farmer is taught to question previous methods used, decisions taken and chemicals supplied. The farmer is also encouraged to select certain less hazardous or so-called "softer" chemicals in the farming-environment. IPM has been described by many authors, but under the CTP, the farmer is taught that it comprises of the consecutive monitoring and integration of all factors like plant stage, and inter-, and intra specific interactions of pest species and natural enemies on a crop.

During the period when the project was initiated, training was aimed towards commercial farmers and small-scale farmers. In certain areas, farm scouts were

trained that would assist the commercial farmers on a weekly basis during the season. However, it soon became obvious, that the demand for training was higher amongst the small-scale cotton growers. The areas where most of these farmers are present include the Groblersdal-Marble Hall area, under which Elandsdoorn, Moutse-East and Moutse West resort, in the Mpumalanga Province. Other areas include the Tonga-area in Mpumalanga, but the main region is represented by the Makhathini Flats in northern KwaZulu Natal (Table 1).

Training methodology

Training sessions

Six check scouts were selected and were trained in scouting at the Cotton Training Center, Kadoma (Zimbabwe) from the 22nd October to the 2nd November 2001. All six check scouts completed the course successfully. In general, the theme of the training course was to emphasize the cotton pests that can be controlled by protecting the natural enemies or the predators of these pests, together with judicious spraying. This is in agreement with the concept of Integrated Pest Management (IPM) using all available tools and methods to monitor pests and predators, in order to reduce chemical sprays on cotton and to conserve the beneficial insects. Since the employment of the check-scouts, it was realized that these scouts were more successful in scouting for small-scale farmers, and training of these farmers.

The number of growers trained under the Cleaner Textile Project

The decision of whether farmers or farm scouts were to be trained during presentation of the courses depended on the area where training courses were held. Course material included scouting sheets, posters, slides, video-material, and a booklet that served as a scouting guide, as well as practical experience on cotton plants in the field and in the classroom. The students received intensive scouting training and practical experience daily by visiting cotton fields that had significant numbers of pests and natural enemies to identify. Other specialized training methods included learning by association, by matching wooden blocks with pictures, large posters with numbered pests, damage and different pest stages (egg, larval, adult & pupal stages). Trainees were also exposed to the correct calibration methods, and the chemicals that are available at present that can be used to control pests, but that would least affect the environment. The training is made more valuable with the use of a video on cotton production methods, as well as the recurrent viewing of a training video on the identification of pests and predators. The latter video is extremely valuable especially to educate illiterate farmers. In addition, the trainees were taught about labeling of chemicals, the reading of a label, safety precautions during spraying to avoid human contamination or water source contamination

and how to dispose of containers. Theoretical work is followed by practical training sessions in the field, where the group is divided into smaller groups and where practical scouting is carried out. A laser disc has been compiled for use by growers at all levels in need of IPM Information, once the Cleaner Textile Project ends. The information can be read on any computer with CD-Rom capability and is based on the diagnosis of a problem based on symptoms shown by the plant. Once the problem is identified, a possible solution or a remedy is suggested and directions are given to mix, and apply chemicals, if necessary, and how the environment must be protected by scouting, timing of sprays and destruction of empty containers. The information will be updated at least once every three years. Accreditation of the training modules (National Qualification Framework, Level, 1 (NQF Level 1) by the Primary Agriculture Education and Training Authority (PAETA) within the frame work of the Standard Generating Body (SAQU), has been granted at the end of 2002 for the module on plant production and insect control.

The potential of building a check-scout system for South African small-scale farmers

The aim of a check-scout system is to make people trained in Integrated Pest Management available to the farmer to perform weekly scouting activities. The check scout in the Weipe area was employed from October 2002 by a commercial farmer in the area, where he would be of assistance for scouting of cotton fields of at least 2 farmers. Up to the end of December 2002 three permanent check scouts that were very valuable to small-scale farmers were, and still are employed under the Cleaner Textile Project (CTP) project. The scouting services, which are run as a non-profit assistance and training service, have continued in two areas since 2000. These check-scouts give a monthly report on farmers visited, thresholds achieved, general comments on chemicals used, the number of hectares scouted and any particular problems that they have encountered. The total number of hectares, which were scouted during the season of 2001/2002, under supervision of the check scouts, is in the region of 674 ha (Table 2), while it has declined in 2002/2003 to be closer to 180 ha. Most of these hectares were planted with the transgenic variety NuCOTN 37B (Bollgard), while only about 19 ha were non-transgenic.

Field reports

Field reports were received on a monthly basis from the check scouts. These reports included a summarized sheet of farms visited, no of ha scouted, stage of the crop, number of sprays applied, cultivars/variety scouted, and other comments. The bollworm treatment threshold on the transgenic variety was never reached during the season in all areas, apart from Weipe. Secondary pests that reached threshold levels included aphids and stainers. Aphids became a problem on most farms from the 7th week after planting, and seemed

to continue to be a problem until very late in the season. Light leafhopper infestations were observed from the 7th week on at least two farms in the Loskop area. From about the 17th week, aphids, jassid and stainers reached the threshold, which emphasizes that scouting for secondary insects including stainers is important. The number of hectares scouted varied between 1-4 per small-scale farmer, and problems that they experienced were generally associated with drought, and the increase of secondary pest populations like aphids and leafhoppers, especially on the genetically modified varieties. The farmers were encouraged to focus on IPM and spraying techniques, and how these could improve their crop. The monthly reports of the check scouts supported the continuation of the training, and success of the scouting that followed training sessions. The farmers reported on, attended the training sessions at least once a season.

As a result of the fact that farmers are becoming more aware of IPM, either by CTP initiatives carried out under this project or because "cleaner farming" is the only way to make farming more sustainable and cost-effective in these drought stricken areas, the need for extended training is higher. It was decided that more farmers could be trained if the basic principles of IPM can be transferred by the check scouts themselves in the rural areas. It was therefore decided that, in order to keep the check scouts up to date with recent developments and best management practices a one-day workshop should be held for them. The training workshop for the check scouts was subsequently held during October 2002 at Cotton SA. The scouts were supplied with a scouting kit, which consisted of a rucksack with pest and predator identification material (wooden blocks with mounted pictures), booklets, pamphlets, a sheet of 1.5 x 1.5 m with an illustration of the development of the cotton plant etc., by the trainers. A number of questionnaires were circulated among growers by the check scouts.

The purpose of the questionnaires was to determine what the status of knowledge about IPM is amongst farmers, and to identify problems that could be addressed in future training sessions. The check scouts circulated these questionnaires to farmers that they worked with, or visited on occasions, and 72 questionnaires were completed and returned. Fifty-four farmers out of the 72 that completed the forms scouted their cotton on a regular basis. Several chemicals were listed to determine their level of use by cotton growers. From Table 3 it was clear that monocrotophos was widely used in the Makhathini. This is a matter of concern, and training will be aimed at teaching farmers not to use such hazardous chemicals that harm the environment.

Fortunately the chemical monocrotophos will be withdrawn from the market in the near future is the only chemical used in cotton production, which prohibits farmers from qualifying to obtain the Eco-label

for their cotton). The CTP project will aim to promote chemicals like acetamiprid, and endosulfan that have lower persistence or no affect on some of the natural enemies of cotton pests. It was clear that the availability of chemicals and the level of knowledge about these substances play an important role in the decision taken whether to use it or not. In the case of fertilizers, very few small-scale farmers make use of synthetic fertilizers, and it is in this area, that the CTP project can play an important role to encourage farmers to make use of organic fertilizers or to use organic sources from their own fields, like cow manure. Valuable information was gathered for further training sessions to through this information.

The response through the questionnaire to CTP-related questions (Figure 1) indicated that very few farmers knew about cleaner production, and everybody wanted more training, and assistance with extension. This confirms the importance of the training session and the importance of informing farmers about the concept of cleaner production. Few apply CTP techniques like crop rotation, intercropping and conservation tillage, while some IPM (CTP) techniques like the burning of cotton stalks at the end of the season are nevertheless carried out to avoid further pest build-up.

Scouting as major IPM principle

Scouting forms the basis of applying IPM principles. Under the CTP project, farmers are taught that farming without scouting is ineffective. Scouting is demonstrated as the consecutive monitoring of pests and predators, from the beginning of the season to at least 20 weeks after planting. Scouting requires accurate checking of all plant parts, starting at the top of the plant and working towards soil level, to check for pests, pest damage, eggs or predator presence on all plant parts. In addition to bollworms, which are the main pests, other pests like leafhoppers (*Jacobiella fasciata* Jac.), whitefly (*Bemisia tabaci* Gennadius), aphids (*Aphis gossypii* Glover), spidermites (*Tetranychus telarius*), thrips (*Thrips tabaci* Lind.), the cotton stem weevil (*Apion soleatum* Wagner), the black cotton beetle (*Syagrus rugifrons* Baly) are also monitored during scouting. In the case of these secondary pests, more emphasis is placed on leaves than on the fruiting bodies, while in the case of the stainer complex, cotton bolls ripe and unripe, and presence on the soil is noted.

Pegboard system

In general, the scouting was easily understood by the trainees, but the actual recording of the findings created some difficulty, especially since many of the small-scale farmers are illiterate. It was then decided that a scouting system by means of a peg-board should be introduced to enable people who are illiterate to be able to scout. The peg-board system entails the marking of pests by means of moving matchsticks in corresponding lanes on a wooden block to a point where the threshold is reached, and thus a management de-

cision should be taken. The results can then be transferred to paper by coloring corresponding circles on a sheet that can be kept as a record by the cotton grower. The peg-board system was explained and identified as the most appropriate system for scouting, since it is easy to handle, practical and could be used by anyone, illiterate or literate. The thresholds used on which decisions for spraying is based, are derived from conventional methods used over the past years in SA, and in neighboring countries, like Zimbabwe and Zambia. The main pests on cotton are the bollworm complex, consisting of the American or African bollworm *Helicoverpa armigera*, red bollworm *Diparopsis castanea* and the spiny bollworm species *Earias biplaga* and *E. insulana*. They are able to cause serious economic damage to the crop.

Integrated farming and best management practices

Farmers are encouraged to accept the modern idea of following best management practices. Good examples or these are those listed by Australian cotton growers. The main concepts that can be applied for the SA cotton grower, is probably the idea of conservation tillage and IPM. Minimum tillage is to the advantage of the small-scale farmer, farming in semi-arid regions since the benefits includes limiting of soil erosion, weed control, limited chemical use by less soil disturbance, etc. In other crops like maize, conservation tillage as been popular. In combination with intercropping of other crops, like wheat it proves to have potential for further development.

Conclusion

The CTP project has succeeded in creating an awareness of IPM amongst emerging farmers, and has made the concept of Cleaner Production more prominent. It does not only mean farming cost-effectively, but by using less chemicals and spraying only when it is necessary it protects the environment and it is therefore in the interest of everyone.

The demand for further training has now arisen and the CTP project has successfully assisted with requirements for the development of appropriate training aids. The project has exposed some farmers to export, although still on a small scale. Training can now aim to suit individual needs of farmers, and the need for publicizing and information transfer on IPM is already prominent amongst the farmers.

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Table 1. The total number of people trained under the CTP project, for the period of May 2000 to February 2003.

Localities	Formal training by PMG during training courses	Informal training by check scouts in each area	Advanced training of check-scouts	Training to people attending courses other than farmers	IPM management: workshop to representatives of industry
Lowveld College, Nelspruit	97			3	
Mpumalanga					
Elandsdoorn, Groblersdal	58			2	
Mpumalanga					
Marble Hall, Mpumalanga	26	16		2	
Moutse East (Area 1, M. Mahlare), Marble Hall, Mpumalanga		6			
Moutse East (Area 2, J. Bodila), Marble Hall, Mpumalanga		9			
Makhathini (S. Mthembu), KwaZulu Natal	31	34			
Weipe, Limpopo	38	4			
Pretoria, Gauteng			3		13
Stella, North West	15?				
Kadoma, Zimbabwe	6				
Total	271	99	3	7	13
Grand total					393

valuable to serving the cotton grower and the successful completion of the growing phase of this project.

Table 2. The number of hectares and farmers served by check scouts employed under the cleaner textile project.

Areas	No of farmers served	Hectares scouted	Bollgard (ha)	Non-Bollgard (ha)
Loskop	16	83	47	12
Makhathini	19	42	35	7
Weipe	4	549	549	0
Total	39	674	631	19

Table 3. Chemicals used by cotton growers (Makhathini).

Insecticides (I) /Herbicides (H)	Makhathini			Dennilton/Moutse area		
	Do they use them?			Do they use them?		
	Never	Sometimes	Always	Never	Sometimes	Always
Monocrotophos (I) & Nuvacron	1	1	36	12	9	3
Thioflo (I)	35	0	0	18	0	7
Mospilan (I)	44	4	0	24	0	0
Cypermethrin/Decis (I)	21	22	5	22	1	1
Marshall (carbosulfan) (I)	48	0	0	23	1	0
Carbaryl (I)	48	0	0	25	0	0
Metasystox (I)	47	0	1	16	1	7
Rogor (I)	45	2	1	21	2	0
Perfektion (I)	47	1	0	23	1	0
Wuxal (Foliar fertilizer)	43	1	4	24	0	0
Nuvacron (I)	31	14	3	24	0	0
Decitab (I)	35	11	2	24	0	0
Any synthetic fertilizers	46	2	1	1	0	26
Dual (H)	48	1	0	11	7	8
Cotogard (H)	48	1	0	24	0	0
Roundup (H)	13	21	16	16	8	0
Dropp (defoliant)	48	0	0	25	-	0
Pix (plant growth regulator)	46	4	1	23	2	-
Irrigation (drip/canals)	47	1	1	22	0	1

Figure 1. Response of small-scale farmers to CTP related questions.

