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Insect War in Cotton Battle Fields

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The views expressed in this column are his own and not that of Cotton Association of India)

EXPERT's Column

Dr K.R. Kranthi

I remember, twenty years ago, a cotton farmer said 'it is a war between man and insects'. I was on a field visit to Guntur district of Andhra Pradesh to collect bollworms for insecticide resistance monitoring. Farmers were angry, frustrated and crest fallen. One farmer had a bunch of receipts. Unbelievable but true, there were about forty bills for insecticides in the bunch. He had purchased insecticides, mixed them as cocktails and sprayed through the season at weekly intervals. And the cause for frustration was that the American cotton bollworm refused to die. Within ten years from 1980 to 1990, the bollworms emerged as major pests of cotton and by 1990 had become resistant to all the recommended insecticides sprayed with an intention to kill them. They were resistant to an extent that even when the bollworm caterpillars were dipped directly into the insecticide formulation, which would otherwise be diluted in 1000 liters of water before spraying, the insects still wouldn't die. This was a pathetic story that had several facets to it. The farmer was actually responsible for the bollworm becoming almost invincible to insecticides by spraying insecticide cocktails desperately and repeatedly. But, it was also scientists and pesticide companies who were the unwitting cause of the tragic story. Their recommendation was -spray insecticides for higher yields. Initially, farmers got good yields because the target pests died and so did the beneficial insects that used to kill the target insect pests. After a few seasons, when the insect pests developed resistance to insecticides, they survived but the beneficial insects were still being killed by the pesticides. The war was based on poor science and therefore helped the target pests win the war eventually.

I need to explain this. It is important to know that insecticides kill all kinds of insects, but are more toxic to some species. There are insects that eat plants and cause economic damage. These are called 'pests'. There are other insects in the same fields that eat pests. These are catagorised as 'beneficial insects'. To complicate matters further, there are also insects that eat beneficial insects and are 'undesirable insects'. And, there is a constant ongoing war between insects in cotton fields all through the season. When a farmer sprays an insecticide, he is actually interfering and disrupting the war only to tilt the balance in favor of some types of insects. Newly introduced chemicals, when used initially, generally kill more than 90% of all types of insects and thus make farmers happy. After a few seasons, some insect types get used to the insecticide rapidly whereas others are slow. When the pests develop resistance rapidly, they get an edge over the beneficial insects and use the advantage to win the war, especially when the insecticide is used regularly. Farmers also help pests by cultivating insect-susceptible varieties, which give the pests good food so that they can keep fit. Many chemicals used as insecticides also affect plant physiology that sometimes makes plants 'green-phase' or take them to senescence. This also tilts the balance in favour of pests.

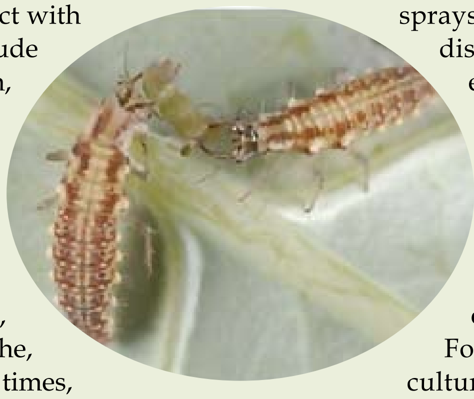
It is important to know that the American bollworm, Helicoverpa armigera was not a major pest of cotton in India before 1980. It was induced by a group of insecticides called 'pyrethroids' which were introduced into India in 1980. A combination of factors such as 'wide-spread cultivation of American cotton hybrids' coupled with 'extensive use of synthetic pyrethroids' and 'high toxicity of pyrethroids beneficial to insects' eventually helped American bollworms attain the status of 'incorrigible-invincible-intractable-insect pest'. There are other stories related to mealy bugs which are small insects with a wax coating on their body. Insecticides do not affect them as much as they kill beneficial insects. Thus mealy bugs survive and spread more when insecticides are used to control them.

What makes insects invincible? Why is it that insect have the capacity to develop resistance to any kind of chemical that scientists invent? Several biotypes of mosquitoes and houseflies are now known to survive the deadly DDT and BHC, which were thought to decimate them, when used first. It is often said that a nuclear war can decimate all living beings, but cockroaches could survive. That brings home the point that the war will be won by insects because of their evolutionary strength. Scientists often remind us that it is a fallacy to think that insects can be wiped out. It is important to remember that the earth belongs to insects. The planet earth has been inhabited by insects for more than 330 million years. Human beings evolved only 1.5 millon years ago. Insects survived everything that decimated the dinosaurs and many other species on earth. Insects are probably destined to win the war, but human intelligence should find ways to live with them without getting affected.

How do insects develop resistance? When an insecticide is used initially, it actually kills about 99% of the insects of the same species. The insects that survive are likely to have resistance genes in them. These insects later become the source for resistance through recurrent survival from the repeated onslaught of insecticides and thus gain advantage to finally evolve into an insecticide-resistant species. The World Health Organization (WHO) defined resistance as "the inherited ability of a strain of some organism to survive doses of a toxicant that would kill the majority of individuals in a normal population of the same species".

Thus far there are more than 12,000 documented cases of insecticide resistance in 168 countries from 596 insect species to 421 different insecticides. Cotton insect pests find their place in 10 out of the 20 most 'resistance-prone' insect species. Five cotton pests feature in the top six ranks. Interestingly, the cotton bollworm tops the list with the highest number of resistance cases. More than 63% of insecticide resistance cases are from agriculture and 28% of cases from insects of medical importance. This is because of the extensive use of insecticides in agriculture and public health. The highest number of resistance reports was from USA with 2400 cases followed by 850 from Pakistan, 700 from China, 600 from Australia and 400 from India.

Indian farmers continue to use deadly insecticides in cotton fields and on food crops. Several insecticides being used the country are considered to be extremely hazardous to the environment and which have been severely regulated by the FAO (Food and Agricultural Organization), WHO (World Health Organization) and the UNEP (United Nations Environment Programme).



Insecticides such as monocrotophos, phorate, methyl parathion, dichlorvos, carbofuran, methomyl, triazophos and metasystox and phosphamidon are highly hazardous and extremely dangerous to human beings and the environment. Unfortunately several state agricultural universities in India still recommend them for pest management in cotton and other food crops. These insecticides have been banned and phased out by several countries across the globe. The above listed insecticides pose acute hazard to developing countries where the lack of protective clothing and mechanical equipment makes farmers/farm workers vulnerable to direct contact with chemicals. Medical effects include nausea, diarrhoea, blurred vision, and, in severe cases, respiratory depression, convulsions and death. Effects reported in workers repeatedly exposed to methyl parathion include impaired memory and concentration, disorientation, severe depressions, irritability, confusion, headache, speech difficulties, delayed reaction times, nightmares, sleepwalking, drowsiness and insomnia. Some of these chemicals fulfill one or more of the following criteria: highly acutely toxic, known/probable carcinogen, known groundwater pollutant or known reproductive or developmental toxicant, unacceptably high risk to workers, to wildlife, especially avian and aquatic species, and to trade. It is a pity that these chemicals are still being used extensively for pest control in cotton.

The cotton insect pest management strategies from CICR listed below come from relatively simple thinking and can create a win-win situation for all warring groups in the cotton battle field.

1) It needs scientific selection of the most appropriate chemicals that can be as specific as possible to kill insect pests with least effects on beneficial insects. Bt cotton is an excellent example of such a pest specific management strategy.
2) It is necessary to reduce insecticide interventions so that selection pressure is reduced.
3) Farmers should not use the same chemical group for more than once in a season.
4) It is important to design a rational and sensible sequence of insecticides that are effective on the target species, and cause least disturbance to beneficial fauna and minimise selection pressure
5) It is better to depend more on pest resistant varieties, natural control, biological control with least interference of insecticides.

Strategies such as the cultivation of sucking pest tolerant varieties and chemical seed treatment, helps in delaying the first spray, thereby conserving the initial build-up of beneficial insects as natural enemies. Also avoidance of insecticide sprays initially in the season, prevents disruption of the beneficial insect ecosystems early in the season. The use of neem-based products and biological pesticides also helps to control sap-sucking insects.

Bt cotton is highly effective in controlling bollworms in an ecologically acceptable manner. For non-Bt varieties, apart from other cultural and biological control methods, the newly introduced insecticides can be effectively used to keep the bollworms under check. Spray Spinosad or Indoxacarb or Chloantraniprole or Flubendiamide for bollworm control and spray synthetic pyrethroids for pink bollworm management during late fruiting phase. Expensive insecticides such as spinosad, emamectin and indoxacarb may be used in irrigated regions with high input use, wherein bollworm infestations are more severe.

Conclusion: The insect war will continue in the cotton battlefields. We need to get rid of many poisonous insecticides from the country so that cotton farmers, food crops and our environment can breathe free of the extremely hazardous pesticides that are being used now. We must strengthen our science to develop pest varieties that can allow insects to survive without causing economic damage to the crop produce. In other words: If you can't beat them, join them. Thus the final message is Make Peace With Insects.

Long Term Trends in the Cost of Cotton Production

The cost of production relative to the expected price received is the determining factor farmers consider when deciding whether or not to plant cotton and if so how much. The price of cotton is highly variable, but farmers always have a good idea of how much it will cost to produce a hectare of cotton compared to competing crops. While prices received for cotton may vary significantly from year to year, the cost of production usually does not change drastically unless yields fluctuate. Knowing the cost of production helps farmers make at least a short term plan to determine a cropping pattern including both competing and rotation crops. Increases in production costs stemming from changes in the prices of inputs and agronomic practices are relatively predictable. Input prices and the costs of farming operations tend to increase, unless an important component of input costs is replaced by a less expensive option, such as the use of insect resistant biotech cotton replacing insecticide use. But, such technological shifts are usually adopted slowly.

There are only a few countries where farmers know in advance the price they will receive with certainty. In these countries, the government, often after negotiations with ginners and farmers, fixes the price for seed cotton; farmers then decide how much area to plant. In countries where prices are announced in advance, public or private companies often supply inputs at prices negotiated with government regulators or producer organizations. Knowing the price to be received for cotton and the cost of inputs allows farmers to make decisions based on their estimates of net income, although yields are always variable.

When companies supply inputs for cotton production, they often refuse to supply similar inputs for competing crops since doing so would undermine cotton production and the likelihood of input-cost recovery. Consequently, farmers may feel pressure to produce cotton even in years when their expectations of net income are not favorable. In almost every situation in which prices paid to farmers are fixed in advance, the cost of production is estimated carefully to make certain that the farmer has an economic interest in producing cotton.

The International Cotton Advisory Committee (ICAC) has been conducting surveys of the cost of producing cotton since the 1960s, but the early surveys were conducted at irregular intervals. However, since 1992, the cost of production survey has been updated every three years. The last eight surveys have been based on the same questionnaire, making it easier to compare results from one survey to another. The same questionnaire was sent to ICAC Coordinating Agencies in ICAC member countries and to researchers or other contacts in non-member countries. Thus, the sources of information vary among countries, but the data are official. Information from non-official sources, such as private companies, have not been used. Questionnaires are sent in April/ May of each survey year, and the resulting report is published in September/ October before the ICAC Plenary Meeting.

The latest full report, 'Cost of Production of Raw Cotton,' can be requested at publications@icac.org. The latest report, published in September 2013, contains data for the 2012/13 cotton production season.

ICAC

The surveys are designed in such a manner that all components of the cost of production are covered in each survey. Production systems vary from completely mechanized to partially mechanized, from animal traction to manual cultivation, and sometimes even a mix of all the above. Cotton may be produced under irrigated conditions or may be entirely dependent on rainfall. Certain inputs or operations are country-specific and also depend on specific production or farming systems. This explains why the answers to all the questions asked in the survey questionnaire are not necessarily available from all countries. There is not a single country that has provided data on all the inputs and operations listed in the questionnaire, another indication that the questionnaire covers a wide variety of production practices and systems. In the most recent survey, respondents were asked to report the technology fee for insect resistant and herbicide tolerant biotech traits independently of the cost of the planting seed. Respondents were asked to report using a given unit (e.g. kg, liter, mandays, etc.,), quantities per hectare, price or cost per unit and for each item, the total cost in local currency and in US dollars. The inputs and operations covered in the survey questionnaire are on the next page.

Once the cost of production per hectare is known for each farming operation or input used in various growth stages (pre-sowing, sowing, growing, harvesting and ginning, including economic and fixed costs), the net cost for seedcotton and lint can be calculated. The respondents were also asked to report additional information to calculate income from selling seedcotton, lint and commercial seed. The cost of producing a kilogram of seedcotton and the net cost of producing a kilogram of lint, i.e., total

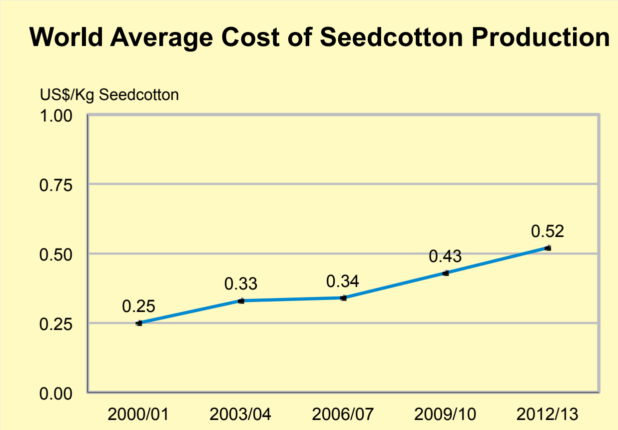
cost minus land rent and the value of commercial seed (seed after ginning), were calculated. Land rent is also excluded from the cost per kg of seedcotton.

World Average Cost of Production Per Kg of Lint and Seedcotton

Since the same data has been collected regularly at three-year intervals since 1992, and since the sources of information have mostly been the same institutions, averages can be calculated for the costs of various inputs at regional and world levels and compared over time. Thirty-two countries, accounting for almost 90% of world cotton production, participated in the 2012/13 cost of production survey, including Argentina, Australia, Bangladesh, Brazil, Bulgaria, Cameroon, Chad, China, Colombia, Egypt, Ethiopia, Greece, India, Iran, Israel, Kazakhstan, Kenya, Mali, Mozambique, Myanmar, Pakistan, Philippines, Senegal, South Africa, Spain, Sudan, Tanzania, Thailand, Turkey, Uganda, USA and Zimbabwe. Because some countries provided data for multiple regions, the total number of entries in 2012/13 was 53; 28 rainfed entries and 25 irrigated entries. Only the long-term trends in world costs are reported in the current article; comparisons among countries will be presented in the March 2014 issue of the ICAC RECORDER.

The average net cost of production in the 32 countries participating in the 2012/13 survey rose to US$1.50 per kilogram; an increase of 28 cents compared to the average net cost of production in 2009/10. The 23% rise in the cost of production in this triennium was greater than the increase between 2006/07 and 2009/10. The main reason for the increase was an increase in the cost of weeding. The use of herbicides is still not common in many countries, while the cost of labor and cultivation are increasing everywhere.

The average cost of production of seedcotton increased from US$0.43/kilogram in 2009/10 to US$0.52/kilogram in 2012/13. These cost estimates are based on the assumption that farmers are cultivating their land themselves and are not paying rent for land use. Some countries do not have a land

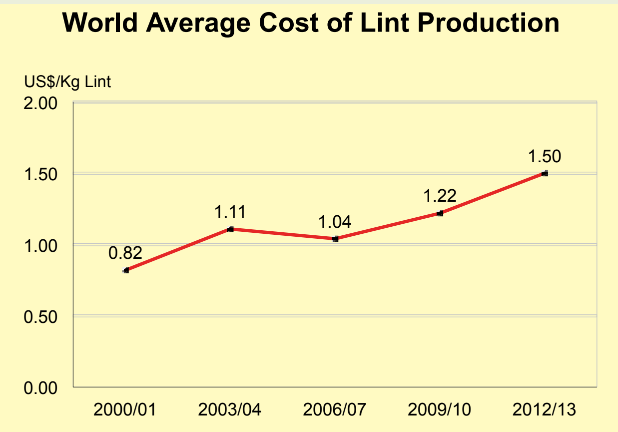


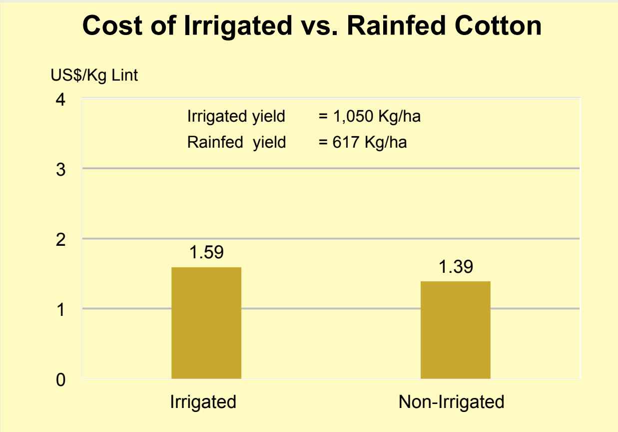
rental market, and out of 32 countries 14 did not report land rent. In the case of countries that did report land rent, the land rent value was deducted from the total cost for calculating the cost per kg of seedcotton. The percentage increases in the cost of production per kilogram of seedcotton and lint between 2009/10 and 2012/13 are nearly the same, and the small differences in measured costs might be due to errors in measurement, especially because of a lack of data from some countries on ginning costs.

Irrigated and Rainfed Cotton

The 32 countries that participated in the 2012/13 cost of production survey planted 61% of their area under irrigated conditions and 39% under rainfed conditions. The cost of production under irrigated conditions averaged US$1.59 per kilogram of lint, compared to US$1.39 per kilogram under rainfed conditions. In other words, when rainfall is abundant enough to make irrigation unnecessary, rainfed cotton production is cheaper than irrigated cotton. Presumably, farmers choose to irrigate only in situations where irrigation is necessary.

On average, the net cost of production per hectare was US$1,658 under irrigated conditions and US$860 under rainfed conditions —about half the irrigated cost. The average yield per hectare for irrigated cotton in 2012/13 was 1,050 kilograms of lint, accounting for 73% of world production. The average rainfed yield among the reporting countries was 617 kilograms





of lint per hectare, accounting for 27% of world production. When one takes into account the Cotlook A Index price for 2012/13 and the average cost and yield under irrigated verses rainfed conditions, the conclusion is that farmers are receiving more net income from irrigated cotton than from rain-fed cotton. The greater yields under irrigated conditions more than compensate for the higher cost of irrigated production over rainfed cotton production.

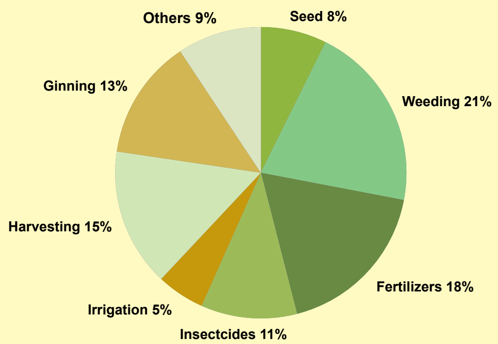
Structure of the Cost of Production

Of the net cost of lint production, 21% or about one-fifth, went to weed control, followed by 18% spent on fertilizers. The cost of insecticide use on cotton declined over the last decade and stood at only 11% of the net cost in 2012/13. Irrigation accounted for 5% of the net cost, harvesting was 15% of the net cost, and ginning was 13%. Planting seed, including the technology fees in the countries that have adopted biotech cotton, accounted for 8% of the net cost of production, or 11 cents per kilogram of lint. As with all other inputs and operations, the reported cost of irrigation represents the average cost of water per kilogram of lint produced in all the countries that participated in the survey. In 2012/13, a typical cotton grower spent an average of US$1,332 to produce, harvest and gin the production of a single hectare of cotton. As stated in the beginning, the world average net cost of production in 2012/13 was

Actual Net Cost Per Kg of Lint Produced

Input/Operation	Cost/kg of Lint Produced (US$)
Planting seed	0.11
Weeding	0.31
Fertilizer	0.27
Irrigation	0.08
Insecticides	0.16
Harvesting	0.23
Ginning	0.20
Others	0.14
Total:	1.50

Structure of Cost of Lint Production – World Average



$1.50/kg of lint. The average of the 32 countries that participated in the survey showed that farmers spent the following amounts on each input and operation in 2012/13.

The reported cost of planting seed includes the cost of seed and seed treatments, which are given separately by at least one-third of the reporting countries. The cost of weeding includes all weeding operations, both chemical and mechanical. Harvesting includes stick cutting, thrashing and incorporation, and ginning includes the cost of transportation to the gin and classing, both seedcotton and lint. Other costs include pre-sowing operations, drilling and sowing seed, economic costs and fixed costs.

Weed Control

Proper weeding has always been critical for achieving high yields. Weeds can be removed through cultural operations such as forming ridges or loosening soil to retain water, manually, mechanically or chemically, and it is very important to remove weeds before they are able to form seeds. Manual and cultural methods are now generally less common than in the past because of farmers' inability to get rid of all weeds, the rising cost of operations and the need to return to the field for more weeding. If weeds are not removed and inputs are applied, weeds take a heavy toll on the cotton crop and almost certainly cause economic losses. Mechanical weeding is more environmentally friendly than the use of herbicides, but it is nearly impossible to get rid of weeds that are close to cotton plants or in between plants in a row using mechanical means. Mechanical implements can be used only until plants reach a certain height, and it is always a problem to eliminate climbing weeds like lily.

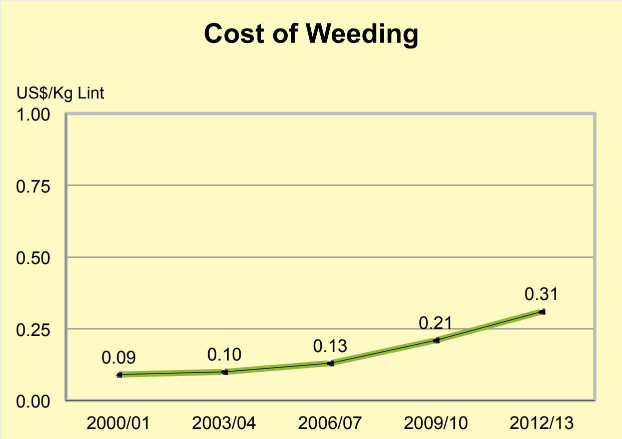
The use of herbicides has environmental consequences, but an increasing number of countries are adopting herbicides, albeit at a slow pace. Herbicides provide nearly perfect control for a longer time compared with mechanical control if they are applied properly. Herbicides can be used pre- or post- sowing, depending upon the field situation and the probability of eliminating weeds. Herbicides have been used for over 60 years, much longer than insecticides. Farmers must rotate classes of insecticides frequently to avoid the development of resistance and to respond to changes in pest populations in response to control methods. In contrast, the weed complex has not changed much in most countries. One of the first herbicides used in the world 2,4-D is still being used today and remains one of the most commonly used herbicides in the world.

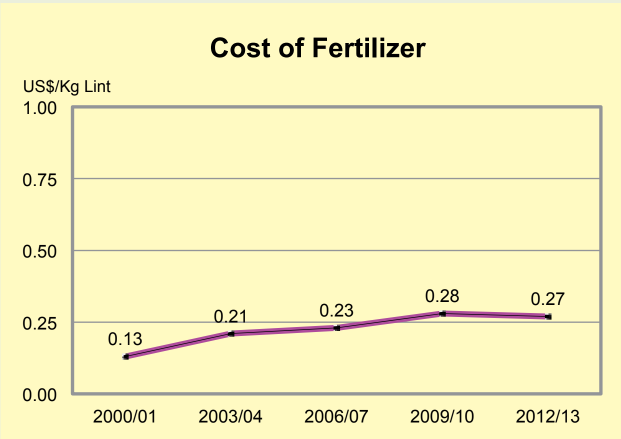
Herbicide tolerant cotton was commercialized in the 1990s, one year before insect resistant cotton was released. Even though herbicide tolerant cotton varieties have been available for almost two decades, most countries that were not using herbicides in the 1990s are still not using herbicide tolerant biotech cotton on large areas. Herbicide tolerant biotech cotton led to increased use of herbicides in the countries that were already using herbicides. However, as the current survey documents, the cost of weed control is rising, therefore concerns about weed control costs are rising. Nine US cents were spent per kilogram of lint production in 2000/01, compared to 21 cents per kilogram of lint in 2009/10, and 31 cents per kilogram of lint in 2012/13.

Weed control costs are rising because of the higher costs associated with field operations and because farmers are placing a greater emphasis on weed control in order to raise yields. Higher weed control costs are encouraging research into less expensive weed control means that are effective and provide control for a longer time.

Fertilizer Costs

Fertilizer use has always been a function of the cost-benefit ratio, and that ratio was extremely high for most farmers when synthetic inorganic fertilizers were introduced. In the early years of fertilizer use, farmers were able to correct nutrient deficiencies in soils in accordance with the actual needs of plants in each field by using synthetic fertilizers. However, the introduction of synthetic fertilizers has tempted farmers to overlook organic fertilizers because they are slow in action, they are required in voluminous quantities and because it is very difficult to closely





match the nutrient needs of plants with organic fertilizers. However, the reduced application of organic fertilizer has led to deterioration in soil texture in many areas, particularly a lack of organic matter and micronutrients, and this deterioration reduces the benefits of inorganic fertilizers. Consequently, the cost/benefit ratio on the addition of inorganic fertilizer is not nearly so positive anymore.

The cost of acquiring and applying fertilizers more than doubled in the nine years from 2000/01 to 2009/10. In 2000/01, the typical cotton grower spent an average of 13 cents on fertilizer to produce a kilogram of cotton lint, compared with 28 cents in 2009/10 and 27 cents in 2012/13. The data indicate that farmers are no longer increasing the quantity of fertilizers used per hectare of cotton, and they are finding ways to maximize the benefits of the nutrients that have already been applied.

Insecticide Use

The third most important component of the cost of production is insecticide use. Weeding, fertilizers and insecticides formed 50% of the net cost per kilogram of lint in 2012/13. In 2000/01, the average farmer spent 17 cents on insecticide use to produce a kilogram of lint, compared to 9 cents on weeding and 13 cents on fertilizers.

While the cost of weeding has been continuously on the rise and the cost of fertilizers increased until 2009/10, the cost of insecticides and their application has been on the decline. Based on the average of the 32 countries that participated in the current survey, a cotton grower spent 16 cents on insecticides in 2012/13 to produce a kilogram of lint —almost the same as in 2000/01 but much lower as a percentage of the net cost.

There are many factors responsible for the decline in insect control costs. The adoption of insect resistant biotech cotton undoubtedly reduced the need for insecticides. The cost of insect control operations may have remained the same since 2000/01, but the biotechnology fee is included in the costs of planting seed rather than being accounted for as a form of insecticide. Countries suffered because of their heavy reliance on insecticide use, and the negative consequences of insecticide use are better understood now than when they were introduced and broadly encouraged in the 1960s and 1970s.

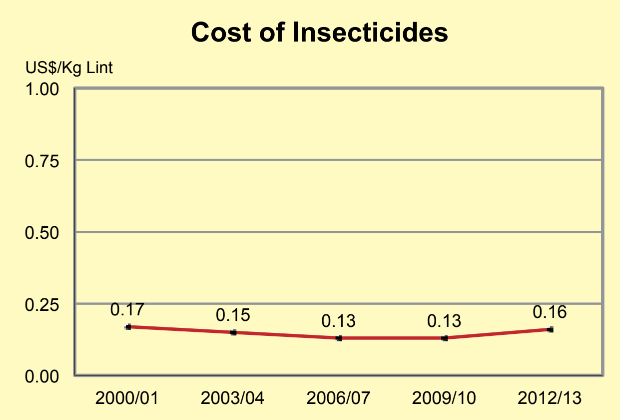
Apart from the severe consequences of over use of insecticides and the more complete understanding of their chemistry, the cost of insecticides also played a role in encouraging a reduction in use. Insecticides were often subsidized and promoted by governments before it was realized that insecticides are not a viable long-term solution to insect management. The development of resistance was not foreseen prior to the introduction of insecticides. With the improved understanding of the consequences of insecticide use, confidence in non-chemical control measures has grown over time.

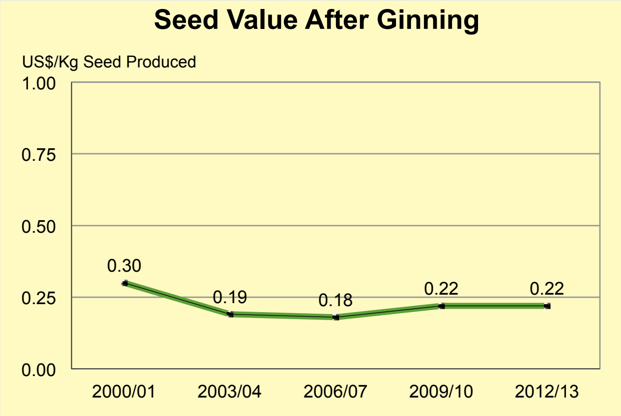
Value of Commercial Seed

Cotton growers may sell their product as seedcotton or they may have it ginned and sell it as two separate items: lint and cotton seed. When seedcotton is sold, it may be sold directly to a ginner or to a middleman for ginning. In this situation, the ginner is responsible for all ginning costs, which he recovers from selling seed. The ginner also owns the lint. In countries where average farm size is larger, custom ginning is popular and farmers pay for ginning and retain ownership of both the lint and the seed. Even if custom ginning is not popular in a given country, a farmer selling seedcotton is receiving an implicit price for the lint and for the seed, although the prices are not separately identified. The value of seed after ginning, which is a substantial amount in many countries, has been deducted from the total cost in order to determine the net cost per kilogram of lint. Thus, the value of seed has a significant impact on the net cost of production per kilogram of lint.

On average, 1,498 kg of commercial seed/ha was produced in 2012/13 in the 32 countries that participated in the current survey, and the value of that seed per hectare averaged US$328, or US$0.22 per kg.

In the five surveys conducted in the last 12 years (one every three years), the value of seed was the highest in 2000/01 (30 cents per kilogram of seed), thus lowering the net cost of production to only US$0.82 per kilogram of lint. The long-term trend





shows that commercial seed has usually been sold at around 20 US cents per kg. However, there is a great deal of variation in prices for commercial seed from country to country.

The value of cotton seed in 2000/01 was unusually high, perhaps due to tight supplies caused by a reduction in planted area.

Consequences of Escalating Costs

The cost of production of seedcotton has been increasing for the last 12 years, and the increase has had repercussions. Cotton production must continue to be an economically viable choice for farmers if they are going to continue to produce. The economic viability of cotton is directly related to the net cost of production, the net cost of producing competing crops and prices for cotton and competing crops. However, given that prices of cotton and competing crops are highly variable, the cost of production is the most significant factor affecting farmers' choices of whether or not to plant cotton. If the cost of production of cotton continues to increase without proportional increases in the price of cotton, it is going to have many impacts on the cotton sector.

• Farmers' income will suffer and a big shift in the location of cotton production may take place. Countries and areas where producing cotton is expensive will shift to other crops, while low cost producing areas or countries may or may not compensate for the shortfall in supply.

• In countries where the cost of production is already higher than market prices and farmers are continuing to produce cotton because of government support, those government support programs will have to come up with additional funding for cotton producers.

• Consolidation of farming operations is one of the means to lower the cost of production. In the USA, the average size of a US cotton farm in 1946 was about 7 hectares. Average farm size increased and stabilized around 180 hectares, which is probably an economical unit in terms of a c ost of production threshold under the practices currently followed in the USA. Similarly, the size of gins has increased, and the number of gins has declined. Rising production costs will not only trigger a drive to identify ways of lowering the costs of production, but will also bring pressure to bear on researchers to invent methods that are less expensive to implement and will reduce input use.

• If higher costs lead to reduced supplies and higher prices of cotton, demand would be negatively affected.

• If rising costs force farmers to become focused on immediate reductions in the cost of production, researchers and farmers will look for quick fixes rather than investigating and adopting technologies with potential long term beneficial impacts.

UPCOUNTRY SPOT RATES

(Rs./Qtl)

Standard Descriptions with Basic Grade & Staple in Millimetres based on Upper Half Mean Length [By law 66 (A) (a) (4)]							Spot Rate (Upcountry) 2013-14 Crop JANUARY 2014					
Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Strength /GPT	20th	21st	22ndth	23rd	24th	25th
1	P/H/R	ICS-101	Fine	Below 22mm	5.0 – 7.0	15	11360 (40400)	11360 (40400)	11360 (40400)	11501 (40900)	11360 (40400)	11360 (40400)
2	P/H/R	ICS-201	Fine	Below 22mm	5.0 – 7.0	15	11501 (40900)	11501 (40900)	11501 (40900)	11642 (41400)	11501 (40900)	11501 (40900)
3	GUJ	ICS-102	Fine	22mm	4.0 – 6.0	20	8858 (31500)	8717 (31000)	8717 (31000)	8717 (31000)	8661 (30800)	8717 (31000)
4	KAR	ICS-103	Fine	23mm	4.0 – 5.5	21	9645 (34300)	9645 (34300)	9645 (34300)	9645 (34300)	9645 (34300)	9645 (34300)
5	M/M	ICS-104	Fine	24mm	4.0 – 5.5	23	10714 (38100)	10770 (38300)	10826 (38500)	10826 (38500)	10826 (38500)	10742 (38200)
6	P/H/R	ICS-202	Fine	26mm	3.5 – 4.9	26	11585 (41200)	11642 (41400)	11838 (42100)	11867 (42200)	11698 (41600)	11726 (41700)
7	M/M/A	ICS-105	Fine	26mm	3.0 – 3.4	25	11051 (39300)	11107 (39500)	11248 (40000)	11248 (40000)	11248 (40000)	11276 (40100)
8	M/M/A	ICS-105	Fine	26mm	3.5 – 4.9	25	11220 (39900)	11276 (40100)	11417 (40600)	11417 (40600)	11417 (40600)	11445 (40700)
9	P/H/R	ICS-105	Fine	27mm	3.5 – 4.9	26	11838 (42100)	11895 (42300)	12092 (43000)	12120 (43100)	11951 (42500)	12007 (42700)
10	M/M/A	ICS-105	Fine	27mm	3.0 – 3.4	26	11276 (40100)	11332 (40300)	11473 (40800)	11473 (40800)	11473 (40800)	11501 (40900)
11	M/M/A	ICS-105	Fine	27mm	3.5 – 4.9	26	11389 (40500)	11445 (40700)	11585 (41200)	11585 (41200)	11585 (41200)	11614 (41300)
12	P/H/R	ICS-105	Fine	28mm	3.5 – 4.9	27	12007 (42700)	12063 (42900)	12260 (43600)	12288 (43700)	12148 (43200)	12176 (43300)
13	M/M/A	ICS-105	Fine	28mm	3.5 – 4.9	27	11529 (41000)	11585 (41200)	11726 (41700)	11726 (41700)	11726 (41700)	11782 (41900)
14	GUJ	ICS-105	Fine	28mm	3.5 – 4.9	27	11698 (41600)	11754 (41800)	11895 (42300)	11895 (42300)	11867 (42200)	11895 (42300)
15	M/M/A/K	ICS-105	Fine	29mm	3.5 – 4.9	28	11642 (41400)	11698 (41600)	11838 (42100)	11838 (42100)	11810 (42000)	11867 (42200)
16	GUJ	ICS-105	Fine	29mm	3.5 – 4.9	28	11810 (42000)	11867 (42200)	12007 (42700)	12007 (42700)	11979 (42600)	12007 (42700)
17	M/M/A/K	ICS-105	Fine	30mm	3.5 – 4.9	29	11782 (41900)	11838 (42100)	11979 (42600)	11979 (42600)	11923 (42400)	11951 (42500)
18	M/M/A/K/T/O	ICS-105	Fine	31mm	3.5 – 4.9	30	11923 (42400)	11979 (42600)	12120 (43100)	12120 (43100)	12063 (42900)	12092 (43000)
19	K/A/T/O	ICS-106	Fine	32mm	3.5 – 4.9	31	12232 (43500)	12288 (43700)	12429 (44200)	12429 (44200)	12345 (43900)	12345 (43900)
20	M(P)/K/T	ICS-107	Fine	34mm	3.0 - 3.8	33	18137 (64500)	17997 (64000)	17997 (64000)	17997 (64000)	17997 (64000)	18081 (64300)

(Note: Figures in bracket indicate prices in Rs./Candy)