TWENTY FIVE YEARS OF PRESENCE OF THE COTTON BOLL WEEVIL IN THE SOUTH CONE

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Abstract

The cotton boll weevil, *Anthonomus grandis* Boheman, was first detected in Brazil in February of 1983. From there, it moved to neighboring Paraguay in 1991 and subsequently to Argentina in 1993. Today, it is present in the most important cotton producing areas of the region. This insect pest has caused much economic and social damage in the South Cone of South America, repeating the havoc it had previously brought to cotton producing countries in more northern latitudes. At its arrival to Brazil, an eradication program was proposed but never implemented for political and environmental reasons. The boll weevil changed Brazilian cotton geography and the way cotton was grown, from the traditional subsistence crop-sharing system in the Northeast and small holder agriculture system in the mid-South, to present fully mechanized large farming systems of the mid-West, previously not yet infested by the pest. In Paraguay, where cotton was vital to an essentially agricultural economy, the pest has brought an overall area reduction of 80%. In Argentina, it was contained for many years from the great Chaco producing area, now also infested. Control actions are carried out by farmers individually and are a combination of cultural and chemical control methods. Since the arrival of the boll weevil to the region, an increase in pest control costs due to recurrent insecticide sprayings has made cotton production less competitive in the world market. The presence of the boll weevil in the South Cone nullifies any potential benefit of the recently introduced bollworm resistant GM cultivars. Area wide suppression efforts have been initiated in some Brazilian states. With the eradication in the US, countries to the South will have to strengthen their research efforts if they are to continue to produce cotton in the presence of the boll weevil. The author analyses the cotton production in the South Cone since the arrival of the boll weevil.

Introduction

Although the presence of the boll weevil and the damage it caused to cotton in the US, Mexico and Central American countries were known to scientists and plant protection authorities in Brazil, its detection in February of 1983 in cotton fields near Campinas-SP took authorities by surprise with no emergency plan in place to tackle the outbreak of the pest. Within just a few months of its detection in the Southeast, the insect was also detected in the Northeast, some 3,000 km away. Attempts to eradicate the outbreak in the Campinas area were aborted by political and environmental reasons. The impact of the insect on the Brazilian cotton industry was remarkable, converting a traditionally net exporting into a net importing country. In 1991, the boll weevil had crossed the border to neighboring Paraguay where a typical family farming agriculture based on cotton was most severely hit by the pest. In Argentina, the boll weevil arrived in 1993 and, although contained within the northern province of Formosa for many years, it successfully colonized most of the cotton growing areas of the Republic. In Brazil, cotton was displaced to the cerrado area of the central region, not yet infested in the mid 1990's, and became a fully mechanized, high input and large operation activity. Today, most of the cotton growing area of the South Cone of South America is infested by the boll weevil and control costs have either caused a shift into other crops or are making the region less competitive in the international markets for cotton fiber. The objective of this paper is to inform conference attendees on the impact of the cotton boll weevil in South Cone and, possibly, to raise awareness in other cotton producing regions of the world where the insect is not present yet for the eventuality of its introduction in the years to come.

The Arrival, the Spread and the Impact of the Boll Weevil in Brazil

The Arrival and the Spread

Although warnings had been long made on the eventuality of the introduction of the boll weevil into Brazil (Lepage & Gonçalves, 1939; Barbosa, 1977, 1981), no precautionary action was taken and the insect was detected for the first time in Brazilian territory in February of 1983 in the region of Campinas, state of Sao Paulo-SP, in the Southeast (Nakano, 1983). The Brazilian Agricultural Research Corporation-Embrapa dispatched a team of entomologists to the infested area whom confirmed the presence of the pest and surveyed the extent of its geographical range at that time estimated in 3,600 ha and comprising the municipalities of Campinas, Jaguariúna, Santo Antônio da Posse, Americana, Piracicaba, Tietê and Tatuí. An emergency eradication plan was put together with the participation of well-known American entomologists but never implemented for political and

environmental interventions (Barbosa et al., 1986). Resources for the eradication were in place but passion took over reason and helicopters were kept on the ground by court lawsuits while the "weevils were looking for new homes". Frozen weevils collected in early May (fall in the Southern hemisphere) were sent to the Boll Weevil Research Laboratory in Mississippi-USA and examined by William H. Cross who found no difference between them and insects collected in the Southeast USA. Furthermore, Dr. Cross concluded that over 60% of the insects were in partial or total diapause. In July of 1983, the insect was also found in cotton fields of the states of Paraíba-PB and Pernambuco-PE, in the Northeast, some 3,000 km away from the area where it was originally detected in the Southeast. Weevils from the Southeast and from the Northeast were sent to Professor Horace Burke of Texas A&M who found them to be, most probably, of the same origin. As shown in Table 1, the spread of the insect in Brazil was fast and, within less than two years of its first detection in the Campinas area, some 200 municipalities in cotton growing areas of the states of SP, PB, PE and RN had accused its presence.

Table 1. Spread of the boll weevil within Brazil, less than 2 years after its first detection (Barbosa et al. 1986)

State	March/1983		July/1983		December/1983		July/1984		December/1984	
	Towns	Area (ha)	Towns	Area (ha)	Towns	Area (ha)	Towns	Area (ha)	Towns	Area (ha)
SP	6	3,600	43	40,000	43	40,000	81	100,000	81	100,000
PB	-	-	5	10,000	39	40,000	49	100,000	58	150,000
PE	-	-	8	10,000	12	17,400	20	20,000	23	30,000
RN	-	-	-	-	-	-	7	13,000	24	70,000
Totals	6	3,600	56	60,00	94	97,400	157	233,000	186	350,000

From the state of SP, the insect moved to Minas Gerais-MG (1985), Paraná-PR (1986), Goiás-GO (1987) and South Mato Grosso-MS (1991). On the Northeast (NE) front the spread of the weevil was spectacular and within less than three years of its arrival to the state of PB all the cotton growing area of the NE had been infested in 1986, including the state of Ceará-CE, with more than 1 million ha of perennial tree-cotton. From 1998, cotton started its movement from the traditional production areas of SP, PR, PB, PE, RN and CE to the central plateau, in the bioma called cerrado, not yet infested by the boll weevil, specially in the states of Mato Grosso-MT and the western section of the state of Bahia-BA. Today, the insect is found wherever cotton is grown in Brazil.

The Impact, Costs and Control

The traditional crop sharing cotton based agriculture of the Northeast suffered the most with the arrival of the boll weevil to Brazil. Some 2 million direct jobs were lost with massive migration of landless families to large cities of the Northeast and other regions. Over one thousand and two hundred cotton industries were closed down and a net cotton exporting Country became dependent on imported fiber to satisfy the needs of its own textile industry. In the 1984/85 cropping season, Brazil grew 3.7 million ha of cotton and produced almost 1 million tons of lint. For the 1996/97 season, the area had been reduced to less than 0.7 million ha which only produced some 0.3 million tons of lint. During the year of 1997, Brazil spent over one billion US$ to import cotton fiber, cloth, garments and other finished cotton goods to satisfy its needs. Table 2 shows changes in cotton statistics in Brazil since the arrival of the boll weevil. On the other hand, the arrival of the boll weevil to Brazil coincided with a period of reduction of insecticide use in cotton as a result of the implementation of IPM programs in the states of MG, GO, SP and PR. From an average of twenty applications per season, farmers were enjoying good yields with five applications only. The new pest and its high control costs put out of business even the most progressive farmers. As mentioned before, from 1998, a new cotton geography began to be drawn up in the savannah-like biome of Central Brazil called cerrado when rural entrepreneurs, the majority of Southern origin, adopted cotton in rotation with their soybeans, in areas where the boll weevil was not yet present. This new way of producing cotton with large, fully mechanized and high input operations left behind the traditional family farming based cotton production systems. The state of Mato Grosso, where more than 50% of the Brazilian cotton is now produced in farms of over 1,000ha and enjoying yields of up to 2 t of lint per ha, became the new home of the Brazilian cotton. Today, the high input cotton sector of the cerrado made Brazil regain its condition of a net cotton exporter. Nevertheless, farmers are spraying up to twenty

times to produce a crop and the boll weevil has become the most important pest. It is estimated in 120 million US$ per year the additional pest control costs due to the boll weevil. Control methods in Brazil are a combination of legal (dates of planting and deadline for stalk destruction), mechanical (destruction of stalks and spontaneous cotton) and chemical, through the use of insecticides.

Table 2. Cotton area, production and yield in Brazil since the arrival of the boll weevil

Season	Area (1000 ha)	Lint (1000 t)	Yield (t/ha)
1983/84	3,107.3	674.5	0.217
1984/85	3,707.0	964.8	0.260
1985/86	3,325.3	793.4	0.239
1986/87	2,161.0	633.4	0.293
1987/88	2,576.1	863.6	0.335
1988/89	2,229.6	709.0	0.318
1989/90	1,963.8	665.8	0.339
1990/91	1,938.8	716.8	0.370
1991/92	1,971.2	667.1	0.338
1992/93	1,277.1	420.3	0.329
1993/94	1,237.8	483.9	0.391
1994/95	1,228.5	537.1	0.437
1995/96	952.5	410.0	0.430
1996/97	657.5	305.8	0.465
1997/98	879.9	411.0	0.467
1998/99	693.9	520.1	0.750
1999/00	823.8	700.3	0.850
2000/01	868.4	938.8	1.081
2001/02	747.7	766.2	1.025
2002/03	735.1	847.5	1.153
2003/04	1,100.0	1,309.4	1.190
2004/05	1,179.4	1,928.7	1.635
2005/06	856.2	1,037.9	1.212
2006/07	1,096.8	1,524.0	1.389
2007/08	1,077.4	1,602.5	1.487

Source: Conab, June 2008.

Most commonly used insecticides for the control of the boll weevil in Brazil are: methyl parathion, malathion, fenitrothion, ethofemprox, endosulfan, betacyfluthrin, zetacypermethrin, esfenvarelate, bifenthrin and deltamethrin. It is recommended that synthetic pyrethroids may only be used after 75 days after planting (Degrande, 1998). The state of GO has initiated an area wide suppression program now replicated with minor changes in other states. The Federal Government has created a Boll Weevil National Control Program and different options, including eradication, are being considered. Genetically modified cotton varieties against important lepidopterous insects are finally being allowed in Brazil but the presence of the boll weevil almost nullifies any benefit of this technology as farmers will have to do many insecticide sprayings against this major pest. This scenario further complicates Brazil efforts to compete in the world cotton market in a scenario where most of the competitors are boll weevil free countries.

The Arrival, the Spread and the Impact of the Boll Weevil in Paraguay

The boll weevil was detected for the first time in Paraguay in April of 1991, infesting some 35,000ha of cotton in the departments of Amambay and Canindeyú, at the Brazilian border. In 1993, it had moved some 220 km to the West and to the East, arriving to the departments of Concepción, Caaguazú and San Pedro, where most of the Paraguayan cotton was located. In May of 1994, the insect was found in cotton gins located in the outskirts of the city of Asunción, in the Central department. The departments of Paraguari, Cordillera and Caazapá were declared infested in the late summer (March) of 1995. In 1996, cotton fields in the southern departments of Itapúa and Misiones were also found infested (Braga Sobrinho, R & R.V. Cobbe, 1994 and Lajarte Cassanello, A.M., 2007).

Table 3: Cotton area, production and yield in Paraguay since the arrival of the boll weevil

Year	Area (ha)	Production (t of seed cotton)	Yield (kg/ha)
1990/91	414,700	631,728	1,523
1991/92	437,300	391,380	895
1992/93	235,500	420,722	1,787
1993/94	381,200	379,877	997
1994/95	286,71	461,239	1,388
1995/96	306,600	329,751	1,075
1996/97	110,700	139,096	1,257
1997/98	202,000	222,000	1,099
1998/99	166,200	202,283	1,217
1999/00	194,700	246,594	1,266
2000/01	297,800	294,444	989
2001/02	169,700	123,666	729
2002/03	170,000	170,000	1,000
2003/04	270,000	316,000	1,170
2004/05	215,000	198,000	921
2005/06	243,000	180,000	730
2006/07	110,000	106,000	960
2007/08	60,000	58,000	970

Source: Lajarte Cassanello, 2007 & Mario Paredes, 2008 Personal Communication. Alter Vida, Paraguay.

As shown in Table 3, the impact of the pest was quite dramatic and a typically agricultural country with an economy heavily dependent on cotton could not adjust to the new reality. From an area of over 400,000 ha planted to cotton in the 1990/91 season a reduction of 85% was observed in 2007/08, when only 60,000 ha were planted , with an yield reduction of 35% and an increase in 5-8 insecticide applications.

The Arrival, the Spread and the Impact of the Boll Weevil in Argentina

The boll weevil was detected for the first time in Argentina in April of 1993 in pheromone traps located at the Iguazu National Park, in the province of Misiones, bordering with Brazil and Paraguay. In June of 1994, the insect was found infesting some 4,000 ha of cotton in the northeast of the province of Formosa where some 7,000 small holders grew cotton as their main crop and producing less than one metric ton of seed cotton per ha. In order to

contain the spread of the new pest and to protect the cotton provinces to the South, the government launched a control/containment program, banning cotton growing in Misiones and conducting control activities in Formosa. For almost 10 years, the great cotton producing area of the Chaco enjoyed the condition of boll weevil free. In 2002, the insect was collected in pheromone traps in Puerto Bermejo, province of Chaco. In 2006, most of the area grown to cotton in Argentina had experienced the presence of the pest (Brodsky, 2007). Table 4 shows area reduction, production and yields of cotton in Argentina since the arrival of the boll weevil.

Table 4. Cotton area, production and yield in Argentina since the arrival of the boll weevil

Year	Area (ha)	Production (kg of seed cotton/ha)	Yield (kg/ha)
1995/96	1,009,800	1,346,940	1,334
1996/97	955,660	1,029,870	1,078
1997/98	1,133,150	987,210	0,871
1998/99	750,930	617,542	0,822
1999/00	345,950	417,680	1,207
2000/01	410,905	509,405	1,240
2001/02	174,043	218,159	1,253
2002/03	158,209	201,506	1,274
2003/04	266,387	353,799	1,328
2004/05	406,421	448,315	1,103
2005/06	309,194	417,770	1,351
2006/07	428,175	616,877	1,441
2007/08	313,000	498,795	1,594

Source: Brodsky, 2007 and J. Vartparonian, 2008, personal communication.

Summary

The arrival and establishment of the cotton boll weevil in the south Cone of South America caused a complete disarray in the local cotton industry of Argentina, Brazil and Paraguay, more so in the small holder areas of Northern Argentina, Northeastern Brazil and most of Paraguay. Brazil changed its area and way of producing cotton but the present input intensive agriculture is being challenged by other cotton producing countries that are or are becoming boll weevil free. It will be possible for the South Cone to rehabilitate its cotton industry but much effort will be necessary to organize growers to manage, suppress or even to eradicate the pest. Up to now, most research on the boll weevil has been conducted in the US, the results benefitting Latin American countries also infested by the pest. As the US plans to declare itself boll weevil free soon, it will be left up to the countries south of the Rio Grande to develop a comprehensive research agenda. It also should be kept in mind that the development of new products for boll weevil control may not be very appealing to industry, considering the limited area of cotton infested by the pest after the eradication is completed up north. The impact the boll weevil brought to the American agriculture since 1892 and the consequences it still brings to Latin America may stand as a warning to cotton producing countries of other continents. They are blessed for not having the boll weevil and they should do everything possible to keep it away. The growing of genetically modified cotton varieties is making cotton growing cheaper and less risky to human heath and the environment in many countries. The need to repeatedly treat against the boll weevil, in the eventuality of its introduction, may nullify any benefits brought by this new technology.

Acknowledgements

Among those who provided the author with knowledge, support and much friendship in his dealings with the boll weevil, he wants to highlight the names of: Perry Lee Adkisson, Oscar G. Bengoléa (in memoriam), Raimundo Braga Sobrinho, Clayton Campanhola, Roberto V. Cobbe, William H. Cross (in memoriam), Maurice J. Lukefahr (in memoriam), Dial F. Martin (in memoriam) and Don R. Rummel.

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