George Antony

Sugarcane smut: the political economy of biosecurity

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Abstract

The discovery of sugarcane smut in one Queensland cane region, in June 2006, triggered a clear-cut biosecurity response aimed at containment and eradication. Farm financial analyses helped to set the incentives offered to canegrowers to gain their cooperation in the eradication effort financed by the Queensland and Australian governments.

Eradication was abandoned when the smut became endemic in November 2006, and the disease management that took its place was now entirely Queensland's responsibility. A number of conflicting stakeholder objectives had to be reconciled by the Queensland government in determining the type and extent of industry assistance. An independent inquiry was called to consider the scientific, production, economic and social aspects of the problem. Economic modelling of farmer decisions, farm economics analyses and regional adaptation scenarios were carried out. The results indicated that government largesse would not actually contribute to industry's adjusting to the endemic disease. Instead, a smaller but targeted contribution to plant breeding was offered. The industry cooperated with the process and accepted the outcomes.

[1] Department of Primary Industries and Fisheries, Brisbane. george.antony@dpi.qld.gov.au

Disclaimer: this paper presents the author's professional opinion and not Queensland Government policy

Trevor Wilson's suggestions have improved this paper, but remaining errors are the author's responsibility.

Introduction

The objective of this paper is to outline the author's perceptions of political, policy and economic aspects of the biosecurity response to sugarcane smut in Australia in 2006-07.

The method is essentially descriptive. The paper follows the timeline of the infestation and response, recalls the actions of major stakeholders and reviews the analyses carried out by various agencies. Being a real-life policy problem, a perspective of political economy is advantageous for its assessment.

Since 2005, there has been a national institutional framework for dealing with specific introduced pests in Australia. The protocols are laid out in the Plant Health Australia Emergency Plant Pest Response Deed[2] (henceforth, Deed). A key component of the Deed is that, once eradication of the pest is decided, 'owner reimbursement costs' (ORC) are to be paid for all plants or crops destroyed in full compensation for actual- and opportunity costs (CIE 2004). The cost components are outlined in detail and their calculation, including updating with current prices, agreed to by all parties. For farmers, this creates certainty and a financial incentive to cooperate with control measures. For governments, it provides a cap on financial commitments and a way to deflect industry rent seeking.

Cane smut was the first response managed under the Deed. It followed the controversial case of the outbreak of citrus canker in the Emerald region of Queensland in 2004. At that time, the Deed was still being negotiated, uncoordinated State rules regulated the response, and all major stakeholders were subsequently criticized for their role in the canker response (Senate 2006).

Cane smut is a fungal disease of the sugarcane plant that was first recorded in South Africa in 1877. By 1997, it had spread to all canegrowing regions of the world except Australia, Fiji and Papua New Guinea. It can reduce crop yields by over 50% and make ratoon (regrowth) crops unprofitable to maintain. It is highly infectious, and even

[2] The Deed constitutes an agreement between the Australian and State governments about the response and cost sharing if the introduction of a number of prescribed invasive pests and diseases should occur. Separate agreements outline further details of the arrangements reflecting unique characteristics of specific industries/commodities. Thus, Queensland Canegrowers is a signatory to the agreement on sugarcane. For details see:
http://www.planthealthaustralia.com.au/our_projects/display_project.asp?category=2&ID=3&page=all

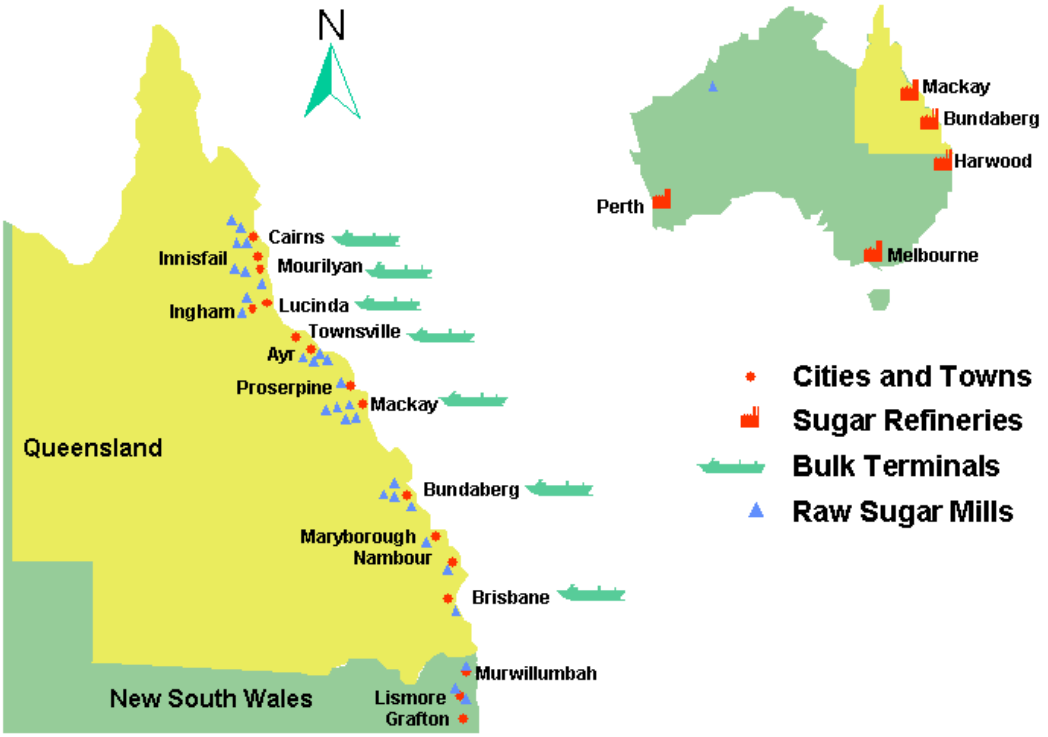
developed countries have been unable to stay smut free even with the use of appropriate quarantine measures (Croft and Magarey 1997).

Queensland's Department of Primary Industries & Fisheries (DPI&F) has responsibilities for both the primary-industries sector and for biosecurity issues in the state. It also manages practices in the sugar industry, among others, by prescribing which varieties can be planted in individual regions. As such, DPI&F carried most of the responsibility within the Queensland government associated with the smut incursion..

Background

The Australian sugar industry

Figure 1 shows the spatial spread of the Australian sugar industry, around 95% of which is located in Queensland, with the rest in northern NSW. The lone sugar mill in Western Australia's Ord region closed in December 2007.



Source: Queensland Sugar Ltd

Figure 1 Geographical distribution of the Australian sugar industry

The Australian, particularly the Queensland, sugar industry has an institutional legacy surprisingly similar to that of the once centrally-planned agricultures of Eastern Europe (Antony 2004). Most important among them for this narrative is the conditioned dependence on government assistance when encountering difficulties. In departure from this, the industry has made substantial progress to reform its formal and informal institutions over the last decade. While government assistance to this process can be justified, its extent was likely to reinforce old industry reflexes. Assistance packages were announced for the sugar industry in 1998, 2000, 2002 and 2004 – the latest in political compensation for sugar's being excluded from the free-trade agreement with the US.

Sugarcane smut in Australia

Before 1998, 70% of Australia's sugarcane varieties were susceptible to smut. Sugarcane smut was first identified in the Ord region of Western Australia on 20 July 1998, probably carried by wind from Indonesia. Due to the extent of the infection at the time of discovery, eradication was not possible in the Ord, as it would have required the complete cessation of canegrowing in the whole region for two years. Instead, Ord canegrowers agreed to manage the disease by ploughing out cane more than 5% infected immediately and switching to resistant varieties, a process that was nearly complete in 2001 (Engelke et al. 2001).

However reduced its impact was, smut still survived in the Ord, requiring the introduction of quarantine measures to prevent the spread to the eastern canegrowing regions. Smut resistance became an objective of varietal selection in Australia that year (Croft and Berding 2005).

Even though the arrival of smut was considered inevitable, many cultivars used in Queensland were still susceptible to the disease. In 2004, 66% of the eastern-Australian sugar crop was from 36 susceptible varieties. Resistant and intermediate varieties numbered five and eight, and supplied 8% and 26% of the crop, respectively (Croft and Berding 2005). Moreover, as the best-yielding new varieties were susceptible, there had been a general movement away from resistant varieties in the industry when smut appeared on the east coast.

Smut in Queensland

First appearance

Cane smut was identified on material from a cane farm in the Isis-Bundaberg region, near the Queensland town of Childers, on 10 June 2006. The control plan previously developed by BSES Ltd with the cooperation of Australian Qarantine Inspection Service was immediately activated, and the property was immediately placed under quarantine under Queensland's Plant Protection Act. Movement controls on machinery were introduced, along with various compulsory measures aimed at confining the pathogen to

the quarantine area. The state government committed $15.6 over four years to fight the disease.

By the end of July, over 50 properties were under quarantine, and the cane industry was warning of dire consequences: 30% to 100% production losses (CANEGROWERS 2006a) and a potential impact of up to $200 million on the Queensland economy (ABC 2006a).

The provisions of the Deed meant that full cost sharing applied to sugarcane smut, including an industry contribution to all costs. The Australian Government was to pay 50% of the government contribution with most of the rest falling on Queensland, due to the location of the industry. Although the sugarcane provisions of the Deed had not been yet completed, negotiations were speeded up to arrive at an interim but compliant figure.

Analyses to aid policy decisions

To underpin the decisions, financial analyses were conducted by DPI&F, CANEGROWERS and ABARE (on behalf of the Australian Government), to model the impact of the disease and the response measures on individual farms and canegrowing regions. The analytical work was done by a working party that included state and national agricultural and treasury departments and sugar-industry stakeholders, allowing for a flow of information and immediate peer review. The short timelines required bare-bones analyses that are just sufficient to answer the policy questions, rather than refined and sophisticated studies.

The initial DPI&F analysis in July aimed at identifying the level of ORC on the basis of a three-year eradication campaign derived from detailed farm budgets and technology assumptions. CANEGROWERS (2006b) supported the destruction of infected crops, and urged its members to take up the offer, even though "the cost of destroying productive cane is significant and the funding will not offset losses which occur as a result". Notwithstanding political statements, the agreed $2000/ha owner reimbursement constituted a level of return to canegrowers that had good incentive value to encourage finding and exterminating disease, rather than trying to hide it.

Other analyses aimed at establishing the extent of potential industry impact. Both CANEGROWERS and ABARE prepared industry models disaggregated to the level of five Pest Quarantine Areas (PQAs) that segment the state north to south. The models compared a no-response approach to sugarcane smut to a response scenario that included eradication in Isis-Bundaberg and a number of quarantine measures in other areas. It was assumed that replanting with resistant varieties would proceed under both scenarios, but the response scenario would allow for faster replacement of all susceptible plants in the infected Isis-Bundaberg region. While even destruction of infected crops in Isis-Bundaberg would not prevent eventual spread of the smut to the whole industry, it was expected to delay it by three-to-four years. BSES scientists produced the expected values for the spread of the disease and its impact on susceptible varieties. These parametric assumptions were subject to extensive debate through the process, and industry stakeholders called BSES estimates 'conservative'.

The CANEGROWERS model calculated the present value of response in each PQA, based on the differences of discounted grower incomes under the two scenarios over 20 years. All PQAs showed a positive expected value for response. ABARE prepared a more detailed model that tested the financial justification of the response option from a societal perspective. They found that a net saving of $119m is expected from the response costing some $45m, resulting in a benefit-cost ratio of 1.56:1.

The policy response

The response measures were thus implemented with the reasonable expectation of a net social gain. Using its legislated powers, DPI&F removed susceptible varieties from the list of varieties allowed for planting in Isis-Bundaberg, but not in other regions. No blanket ban was imposed on the growing of ratoon crops from, or harvesting of, susceptible varieties in Isis-Bundaberg. Instead, the total destruction of heavily-infested stands was ordered, along with the burnt harvesting of light infestations and increased monitoring. Voluntary destruction of infected cane by farmers was to be compensated. Quarantine between and within the PQAs was maintained, and all cane regions stepped up the monitoring of their crops.

Endemic stage

The discovery of smut in a large canegrowing region, Mackay, in early November 2006 radically changed the situation:

- Endemicity of the disease meant that the emergency response was over and the Deed ceased to apply. Queensland was now on its own without binding agreements of help from elsewhere, and given its different political colour at the time, the Australian government was inclined to see smut as a Queensland problem.
- The distance from Childers of over 500 km made it unlikely that the spread resulted from a breach of quarantine, and now the whole $1 billion industry was under threat.
- Even if scientifically sound and physically possible, financing the replication of measures taken in Isis-Bundaberg across the whole industry would have been very difficult for the Queensland government.
- However, the sugar industry, accustomed to government assistance over much smaller calamities, expected substantive help in what clearly was a major crisis.

Immediately, the Queensland government announced an inquiry into the potential economic impact of the disease and the best way to deal with it. The head of the inquiry, an economist with a PhD and a previous state Liberal Party leader, had both professional authority and political independence from the major stakeholders and the government. With the report due mid-February 2007, the government avoided being pushed into making commitments in the heat of the moment. This action also diminished the political fallout from smut's appearance in the largest cane region, the Herbert River area, in mid-December.

The inquiry had two major components: on-the-ground industry consultation and a suite of economic analyses. The purpose was to establish the expected extent of economic impact, and to identify measures to facilitate economic recovery (Watson 2007). The latter question soon turned into a query of how long the industry was willing to live with susceptible cane stands, and whether there were ways/justification for accelerating the replacement of susceptible cane with resistant varieties.

Now for the whole of Queensland, DPI&F had to decide which varieties can be planted, ratooned or harvested at all, where, and when? A total ban on susceptible varieties had potentially large opportunity costs. Northern cane regions had a suite of approved resistant varieties yielding as well as susceptible ones. However, moving south, a yield gap opened and progressively widened in favour of the susceptible varieties. Given that smut was spreading progressively, the optimal year of replacement was when the initial yield advantage of susceptible varieties was overcome by smut losses. Still, a general rule could not be established, as smut was not uniformly established, and neither were growers' expectations identical regarding further spread, yield differentials and the acceptable risk.

Analyses to aid policy decisions

As in the first stage of smut infestation, a working group was established to guide, carry out and critique the analyses. Membership included industry stakeholders, various government departments and an academic economist. Three studies were carried out to aid the inquiry.

O'Donnell (2007) built a model to calculate monetary payoffs and utility values from standing susceptible cane, resistant cane and alternative crops. Low and high probabilities of smut spread were distinguished as separate scenarios. For a low probability, both risk neutral and slightly risk-averse growers should plant susceptible cane, while with a high probability, the best payoff would be from alternative crops for any type of risk preference. The significance of this analysis was not fully appreciated by the working group, distracted by key parameter values chosen by the author and objections to some alternative crops not seen as realistic choices for canegrowers.

Sing (2007) further developed the sugarcane version of DPI&F's Farm Economic Analysis Tool (FEAT) to calculate the financial implications of smut-related decisions. FEAT uses a detailed real-life model of the farming system. Farm operations on each block are followed and enumerated over a number of years. Gross margins and farm-level profitability measures are shown and compared with alternatives containing a different development of the farming system. Populated with smut-spread data applicable to different cane regions, three or four representative farm models were prepared for each region, and presented as part of the local consultation with industry. Results confirmed that enforced replanting with resistant varieties can impose large opportunity costs on farms not yet affected by smut. The use of susceptible varieties for ratoons was a rational choice in many cases and, given favourable smut exposure, even their planting could be profitable in southern regions. The use of FEAT modelling was offered to industry to assist canegrowers in their decision making.

Antony (2007) prepared an industry-wide model of replanting at the level of four major canegrowing regions accounting for 66% of Queensland's cane crop in 2005. The model distinguished and counted areas planted to susceptible and resistant varieties of original and new stands between 2003 and 2006. Their yield advantage caused susceptible varieties to gain in all regions in those years. Between 2007 and 2014, replanting simulations were driven by a simple decision rule that favoured (a) susceptible varieties for the notional base case of no smut, and (b) resistant ones for the smut-infected actual scenario. A technology constraint prescribed the proportion of area replanted. With a six-year crop cycle (fallow, plant crop and four ratoons), normally one-sixth of the cane is replaced every year. Even if farmers wanted faster variety change, machinery capacity limits regionwide replacement to around a quarter of the area. Region-specific data and forecasts on the status, spread and impact of smut on yield and CCS (sugar content) were supplied by BSES. Epidemiological data from Isis-Bundaberg improved industry confidence in the BSES forecasts. Nevertheless, to account for uncertainty, the smut-impact scenario was duplicated based on 'optimistic' and 'pessimistic' forecasts about smut severity. Industry worth of the scenarios was measured as net present values of both total sugar income and farm gross margin at the regional level.

Model runs confirmed that the industry was going to be worse off owing to the smut, but revealed that the likely extent of impact would not be as great as some earlier reports suggested: Table 1 shows the results of calculations for optimistic and pessimistic assumptions about the future severity of smut.

Table 1 *Likely financial impact of smut on Queensland sugar regions*

	Sugar value		**Farm gross margins**	
Region	*Optimistic*	*Pessimistic*	*Optimistic*	*Pessimistic*
Herbert	-2%	-5%	-6%	-13%
Burdekin	-1%	-2%	-3%	-4%
Mackay, Plane Creek & Proserpine	-8%	-8%	-27%	-29%
Isis-Bundaberg	-10%	-11%	-29%	-32%

As large as these impacts are in some regions, they fall within the range of external influences that the industry regularly experiences: even a 10% drop in the sugar price would have a larger effect (Table 2).

Table 2 *Comparison of smut and price impacts on the Queensland sugar industry*

	Sugar value			**Farm gross margins**		
	Base case	*Optimistic*	*Pessimistic*	*Base case*	*Optimistic*	*Pessimistic*
Smut annual $m		78	96		47	55
10% sugar-price drop annual $m	152			98		

Both impacts are calculated in the model as the average of 2007 present values over 2007-14, scaled up to the whole Queensland industry

Thus, smut can be seen as similar in impact to other risks associated with running a sugar business. However, the appearance of the smut had been anticipated since 1998: those choosing to plant susceptible varieties were taking a calculated risk.

The policy option of enforcing a faster rate of replanting was tested by raising the replanting proportion from the regular 17% to 25%. All financial returns in all regions were marginally worse under this option, primarily owing to the higher unproductive fallow area.

While northern regions had an adequate set of resistant varieties for most agroclimatic niches, the choice was much more limited in the south. Moreover, there was a physical shortage of any resistant planting material for Isis-Bundaberg for the autumn 2007 plantings. Hence, the industry requested approval for the limited planting of susceptible varieties at that time. A model run allowing 2000 ha susceptible plantings indicated positive financial results under optimistic smut severity, and a small potential negative outcome should the pessimistic forecast eventuate. While small but positive on the balance of probabilities for 2007, the outcome of a similar small planting of susceptibles was unequivocally negative from 2008.

The policy response

The findings of the Watson inquiry were accepted by both the Queensland government and industry stakeholders. It was agreed that there is no advantage to forcing a faster replacement of susceptible stands than the regular crop cycle. Neither is there a useful way of improving the industry's smut response in the short run, even with large sums of money. Instead, the government could best help by resourcing the accelerated release of new resistant varieties by BSES.

Conclusions

The initial outbreak of sugarcane smut, the first test of the new national institutional framework for managing biosecurity incursions provided positive proof for the concept and the implementation. The predetermined protocols gave clear guidance and they were followed. The affected industry was fully engaged in the process, helped in developing the response and accepted the decisions. Analysis proved that reasonable expectation of net social returns justified the chosen response to the initial infestation.

The situation was much more difficult when the smut appeared in further cane regions. There were no protocols to follow, Queensland faced a potentially catastrophic situation on its own, and old industry attitudes created expectations of substantial financial assistance from the government. Skill in the political reaction of government created the time needed for the quick but adequate analysis of options. The policy decision took full account of the analytical results. It became clear that even generous financial assistance by the government could not improve short-term industry adjustment to the endemic disease. Instead, targeted use of funds for improving longer-term adjustment was decided. Again, the involvement of industry stakeholders in the process helped the acceptance of the decision.

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