Cotton Growers' Attitudes to Issues Related to INGARD® Use

Wayne Hancock
Southern Cross University
Coffs Harbour Campus

The release of INGARD(R) cotton has presented the opportunity to study grower attitudes to the control and distribution of genetic material protected by plant and technology patents and trademarks. INGARD(R) cotton is the first major release of this type in Australia where growers have to enter into legally binding contracts (licenses) to use the plant. This study has been undertaken as part of a PhD program funded by a University Scholarship.

The first survey was conducted in June 1997 and followed preliminary interviews and information gathering primarily in the Gwydir Valley. The survey focused on growers' attitudes regarding issues involved with the release of the transgenic cotton INGARD(R) . A total of 29 responses were received; 19 from growers of both conventional and INGARD(R) cotton and 10 from growers of conventional cotton. Data collected was analyzed on SPSS (a statistical analysis package). Frequency distributions were tabulated to reveal the strength and range of responses to questions. Factor analysis was undertaken on sets of questions to find associations within the sets which affect the adoption of the technology.

The size growers' of plantings varied from 40 hectares to 5600 hectares of conventional cotton with about half below 700 hectares and half above 1300 hectares. Some INGARD(R) growers were growing seed crops as well as INGARD(R) under commercial licenses and some growers had more than one INGARD(R) license because they have more than one property. INGARD(R) areas varied from 28 hectares to 570 hectares.

The format of the questions varied from yes/no answers to others in which growers were asked to rate their response on a scale of 1 to 7 (one reflecting low importance or low acceptability and seven reflecting high importance or high acceptability). There is a possible area of ambiguity in this if the respondent did not closely follow the question because importance of a factor and acceptability of a factor can have an inverse relationship.

Growers were asked to include comments if they felt this helped in their response. The comments received were wide ranging and provided insight into growers' thoughts. Unfortunately this paper is to short to include the comments although they support the general trend in responses. Further analysis will be conducted on the comments and a full transcript is available in the longer version of this paper.

The Importance of the Price, Efficacy, Need for Licensing and Environmental Benefits of the technology.

Table 1

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
5	Price	0	0	3.4	6.9	3.4	37.7	43.8	6.21	1.05
6	Efficacy	0	0	0	6.9	10.3	24.1	58.6	6.34	.94
7	Need Lic.	6.9	3.4	6.9	17.2	24.1	24.1	17.2	4.9	1.7
8	Env. Ben.	3.4	0	3.4	3.4	10.3	27.6	51.7	6.07	1.41

Price was rated at 6 and 7 by 86% of respondents , efficacy was rated at 6 and 7 by 83% of respondents. The need for licensing arrangements was seen as less important with 4 to 6 accounting for 65% of respondents. Environmental benefits scored as highly important with 79% at 6 and 7.

The Acceptability of Technical Support Provided by The Owners, Local Agents and Cotton Consultants.

Table 2

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
9.1	Owner	17.9	21.4	10.7	10.7	10.7	10.7	17.9	3.79	2.2
9.2	Agent	7.1	7.1	21.4	14.3	21.4	17.9	10.7	4.32	1.74
9.3	Cons.	0	3.7	3.7	18.5	18.5	22.2	33.3	5.22	1.42

The owners of the technology rated poorly with 60% of respondents giving a 4 or less although 1 and 7 scored equally, indicating a wide spread of views. Local agents fared better with 75% in the range of 3-6. Consultants scored well with 93% in 4 and above and 56% at 6 and 7.

The Importance of Costs Associated with the Use of INGARD(R) in Relation to the License Package compared to Conventional Consultants Fees and Compliance with License Requirements.

Table 3

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
10.1	Lic Pack	0	0	3.4	6.9	3.4	27.6	58.6	6.31	1.07
10.2	Cons fees	3.6	10.7	14.3	17.9	32.1	7.1	14.3	4.43	1.64
10.3	Compl Lic	3.4	6.9	6.9	3.4	6.9	24.1	48.3	5.69	1.81

The cost of the license package compared to conventional rated highly with 86% in the 6 to 7 scores. Consultant costs scored 64% in the mid range of 3 to 5 and compliance rated highly with 72% in the 6 to 7 range.

The Acceptability of Information About The Technology From the Owners, Researchers, Other Growers and Consultants.

Table 4

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
11.1	Monsanto	24.1	27.6	13.8	13.8	6.9	10.3	3.4	2.97	1.8
11.2	Researchers	3.4	0	6.2	20.7	34.5	24.1	10.3	4.97	1.32
11.3	Growers	0	3.4	6.9	31.0	34.5	6.9	17.2	4.86	1.3
11.4	Consults.	3.6	0	0	17.9	35.7	25	17.9	5.29	1.3

52% of responses rated 1 and 2 and a further 28% 3 and 4, indicating a perceived lack of information from the owners. Researchers were rated higher with 79% in the 4-6 range. Other growers were similar with 72% in the 4-6 range.

The Acceptability of Licensing Arrangements Between Growers and Monsanto, and Between Monsanto and CSD and CSIRO.

Table 5

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
12	Monsanto/ Growers	13.8	10.3	10.3	13.8	13.8	20.7	17.2	4.34	2.07
13	Monsanto/ CSD/CSIRO	27.9	6.9	13.8	17.2	3.4	10.3	10.3	3.14	2.15

42% of growers responded in the 5, 6 and 7 range for grower licenses, indicating some problems in this area. The arrangements between CSD, CSIRO and Monsanto did concern many growers with 75% responding in 4 or less (38% in '1' range).

The Importance Ratings of 19 Points Pertinent to the Decision to Adopt the Technology in the Coming Season.

Table 6

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
14.1	Adopt Lic Price	0	0	0	6.9	3.4	27.6	62.1	6.45	0.87
14.2	Adopt Inf	0	0	3.4	0	34.5	31	31	5.86	.99
14.3	Adopt Con	7.1	0	10.7	14.3	28.6	10.7	28.6	5.04	1.75
14.4	Adopt Grow	3.4	3.4	6.9	24.1	31	6.9	24.1	4.93	1.58
14.5	Adopt Env	0	0	0	17.2	17.2	24.1	41.4	5.9	1.14
14.6	Adopt OCB	0	0	0	10.7	7.1	28.6	53.6	6.25	1.0
14.7	Adopt DEM	7.1	0	10.7	32.1	25	14.3	10.7	4.54	1.58
14.8	Adopt PPB	14.3	3.6	14.3	7.1	28.6	17.9	14.3	4.43	1.95
14.9	Adopt V C0	0	7.1	17.9	28.6	25	21.4	5.36	1.22	
14.10	Adopt Alt 0	0	0	17.9	14.3	28.6	39.3	5.89	1.13	
14.11	Adopt LAR	3.4	10.3	3.4	17.2	13.8	10.3	41.4	5.24	1.9
14.12	Adopt TEC	7.1	7.1	3.6	21.4	17.9	14.3	28.6	4.93	1.88
14.13	Adopt ATO	21.4	10.7	9	21.4	10.7	17.9	17.9	4.14	2.22
14.14	Adopt ATA	10.7	10.7	3.6	32.1	10.7	21.4	10.7	4.29	1.84
14.15	Adopt EFF	0	3.6	0	7.1	7.1	25	57.1	6.21	1.23
14.16	Adopt PS	6.9	3.4	3.4	17.2	10.3	27.6	31.0	5.28	1.81
14.17	Adopt INV	10.7	3.6	7.1	14.3	17.9	21.4	25	4.89	1.95
14.18	Adopt CHG	3.6	0	7.1	10.7	32.1	14.3	32.1	5.39	1.52
14.19	Adopt SAF	0	3.6	3.6	21.4	7.1	17.9	46.4	6	1.51

Price of the technology rated highly with 90% in 6 and 7. Information about the technology rated highly with 96% in 5, 6 and 7. Consultants recommendations rated 68% in 5 to 7. Other growers views rated highly with 86% in 4 to 7. Environmental benefits rated well with 65% in 6 and 7 and all scores above 4, indicating a positive perception of benefits. Own cost benefit analysis was similar with 82% in 6 and 7 and all above 4. Demonstrations at field days rated a lower score with 55% in 4 and 5. Public perception of benefits received a mixed response with equal responses (14%) in 1, 3 and 7 scores. This would indicate a wide variation in growers views towards the public's views. Value to the community of use was generally favourable with 93% in the 4 to 7 range. This raised the question - is the community different from the public? Perhaps growers see themselves as part of the community but not always part of the public. Availability of alternatives rated highly with 68% in 6 and 7. Understanding and acceptability of licensing arrangements was mixed (including 41% in 7) and technical support available also mixed. Both were in the more important range. Attitudes towards owners of the technology received a wide spread of responses with 54% in the 1 to 4 range. This was similar to the attitude towards local agents and support staff. The product would seem to be more important than the attitudes in most cases. It could also reflect a negative or ambivalent attitude towards this group in general. Efficacy of the technology is highly important with 82% in the 6 and 7 range. This is logical, it has to work to be worthwhile. Ability to slot it into a production system and investment required to adopt the technology both rated medium to high importance. The desire to keep up with changes received 79%, 5 and above, reflecting a technology driven industry. Safety to self and employees rated medium to high importance with 64% in 6 to 7 range. This group of questions will be further analyzed, using factor analysis, to define factors.

The Importance of the Availability of Information about License Terms And Conditions, the Openness and Fairness of the Process for Obtaining a License and the Selection Process for Licenses.

Table 7

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
15.1	Lic Tmcon	0	3.4	3.4	10.3	10.3	20.7	51.7	5.97	1.4
15.2	Lic Open	0	6.9	0	10.3	20.7	17.2	44.8	5.76	1.48
15.3	Lic Select	6.9	3.4	9	10.3	6.9	31	41.4	5.66	1.78

All scored highly, indicating the need for readily available information about licensing, openness and fairness in the process of obtaining a license.

The Use of a Comparable (transgenic) Alternative

Respondents were equally divided between using an alternative at comparable/lower costs (52%), and only after full evaluation (48%). This combines cost with caution!

The Importance of Choice in the Marketplace, Different Marketing Approach, Different Licensing Arrangements and Previous Relationship with Supplier in the Decision to use an Alternative Technology.

Table 8

Question No.	Question	% Response 1	2	3	4	5	6	7	Mean	Std D.
17.1	Usaltcho	10.7	3.6	0	10.7	21.4	28.6	25	5.14	1.88
17.2	Usaltmkt	7.1	7.1	3.6	14.3	10.7	28.6	28.6	5.14	1.9
17.3	Usaltlic	6.9	0	3.6	14.3	7.1	42.9	25	5.43	1.67
17.4	Usaltrel	7.1	3.6	10.7	14.3	10.7	21.4	32.1	5.11	1.91

Choice in the marketplace scored 75% in the 5-7 range, marketing approach taken scored 57% in the 6-7 range. Differences in the licensing arrangements scored 68% in the 6-7 range. Relationships with suppliers/owners from previous dealings received a mixed response (although 6 - 7 scored 53%), indicating loyalty to suppliers may not be that important if the product is desired.

The Use of a Conventional Alternative (e.g. a new insecticide)

72% would use a conventional alternative at comparable or lower cost and a further 17% are undecided. Alternatives and choice are desirable for growers.

The Control of Genetic Material by Growers or by Commercial Interests.

Indifferent scored 48%, yes 41% and no 10%. This result tends to support the need for access to and use of, rather than ownership or direct control of material.

Do Growers Feel They Have a Clear Understanding of The Rights and Obligations as a User of Protected Genetic Material.

The yes and no were similar at 45% and 48% respectively with 7% indifferent.

Should Grower and Government Funds Assist in the Development of Material over Which Growers Have no Control

The results show 57% indicated no with yes and undecided evenly divided,

Do Growers and Grower Organizations Have the Expertise to Deal with Issues Involved with the Control and Use of Genetic Material.

The results were 55% indicated yes, 35% indicating no.

Should Growers Pay a Premium for the Environmental Benefits of New Technology and Place a Value on This (Comments Only)

Whilst many growers are prepared to pay a premium for an environmental benefit (up to $50 per Hectare in one case), the environment is also seen as a wider concern, going beyond the farm. Reducing the cost of environmentally friendly products to increase acceptance and encourage wider use is seen as directly beneficial to growers and the environment. This makes good sense for growers but commercial interests may not agree. The issue of community and public is raised - growers are seen as part of the community. Growers recognize the need to remain viable so the cost and performance of the product is critical to use. The longer term issue of sustainability was raised which is important because the perceptions of the environment and what are acceptable practices or not acceptable practices have a long-term bearing on the viability of growers.

Should This Type of Technology Have Objective Performance Criteria Similar to Conventional Products.

The 'yes' group is the largest but how to achieve it equitably is the problem.

Factor Analysis of Question 14

Factor analysis is a statistical technique used to group relatively many variables into relatively few factors which helps explain the association between the variables within each factor. The factor loading matrix identifies subsets of variables that are interrelated, whilst the factors themselves have relatively small relationships.
Four factors were identified from the 19 variables in Question 14 measuring the importance of those variables towards the decision to adopt this technology in the coming season. These four coherently interrelated sets of variables were labeled as follows -:

1. *Information for adoption*
2. *Logistics for adoption*
3. *Attitudes for adoption*
4. *Economics for adoption.*

These were subject to reliability analysis to assess the coherence of interrelationships among the variables in a factor using Crombach's Alpha coefficients. The factors and Alpha coefficients are reported in Table 10 below.

Table 9

Scale Label	Item
Information for adoption	Information about the technology
	Consultants recommendations
	Understanding of and acceptability of
	licensing arrangements
	Efficacy of technology
	Safety to yourself and employees
	Value to the community of use
Alpha = 0.8533	Environmental benefits
Logistics for adoption	Ability to slot into current production system
	Investment required to adopt the technology
	Environmental benefits
	Technical support available
	Your desire to keep up with changes
	Your attitudes
Alpha = 0.8161	Safety to yourself and employees
Attitudes for adoption contains	Your attitude towards owner of technology
	Demonstration at field days or similar
	Your attitudes towards local agents
Alpha = 0.6967	Other growers views
Economics for adoption	Price of license to use the material
	Own cost benefit analysis
Alpha = 0.5702	(Negative) Public perceptions of benefits **

**The negative value for public perceptions of benefits indicates this variable is related to the other two in a way such that it would score at the lower end of the scale if the other two scored highly and vice versa. In this case it would indicate a low importance in decision making compared to the other two variables.

Differences Between Growers of INGARD and Growers of Conventional Only

There are many possible differences between these grower groups which could be expected to be reflected in different attitudes. The Mann-Whitney test was used to assess differences between the groups. The results are reported in Table 11.

Table 10

Scale Name	Mean Ranks INGARD	Mean Ranks Conventional	Significance of Mann-Whitney Test
Information for adoption	14.39	16.15	.604
Logistics for adoption	14.5	15.95	.668
Attitudes for adoption	13.29	18.25	.138
Economics for adoption	13.73	17.6	.247

Although the sample size is small, the relationships are statistically sound. The growers of INGARD(R) and the growers of conventional only were not significantly different in their approach to adoption. However, it appears likely that with a larger sample of conventional only growers significant differences would have been found in the Attitudes for adoption and Economics for adoption. The respondents answers in these questions have the least overlap and therefore a larger sample would find a significant difference if it existed.

Information for adoption about the technology is the first link to adoption. Lack of information was a major concern of growers interviewed. The second season of experience with the technology should provide more information necessary for future decision making.

Logistics for adoption relate to the production system decisions. Growers have to be able to fit the technology to their situation. The second season should also help with decisions relating to this factor.

Attitudes for adoption focus on growers attitudes towards the owners of the technology, their agents and demonstrations at field days with other growers views included. Although many growers had unfavourable views about the owners, agents and lack of information from field days, this does not mean they will not use the technology if it meets other needs.

Economics of adoption fits the cost/benefit concept. The interesting point of this is the relationship between the benefits to growers and the 'public'. The notion of the 'public' having a bearing on growers own cost/benefit analysis is not seen as favourable by growers. Yet, the value to the community is an important variable in information about the technology. Does this mean growers view the community as something close they may be part of but the public in general is more removed, not part of the community?

The possibility of a difference between the grower groups on attitudes and economics is important to explore further. If conventional only growers were found to have a difference in attitude and economics, this would affect the way they make decisions relation to adoption. A negative attitude to the owners of the new technology could inhibit adoption.

Outcomes

Whilst the need for licenses seems to be generally accepted, what is in the license, the legal implications, the process involved with obtaining a license and understanding it all is of concern. This may not stop growers from signing a license to gain access to the material.

How the genetic material was distributed was more a concern. The secrecy leading up to the release of licensing details (and price of the technology) and the manner in which growers could obtain a license was seen as a problem. The limited release and late approval for release contributed to this. The price charged and the need to understand license arrangements scored highly in importance. Most growers also felt licensing was necessary to manage the technology from a pest management perspective, although this is only a part of the legal implications of a license.

The technical support and information available to growers at the start of the season and throughout the season from the owners of the technology was seen as inadequate. This is supported by the owners actions in changing the composition of the field team involved with INGARD(R) at the end of the season. However, lack of information about many aspects of INGARD(R) is an ongoing concern. Questions such as who owns the information generated in the first release trial licenses still need to be answered.

The urgency in pushing the technology on to the market is an important consideration. The withdrawal of the effective Helix insecticide from the market helped create this urgency. One more seasons data could have made a difference to the information available.

A number of growers expressed concern about agreements between Monsanto, CSIRO and CSD. These are commercial in confidence and therefore not readily available. Concerns were expressed that CSD may have been placed under considerable pressure by the limited timeframe for release and compromised in some way. Similarly, the information flows from CSIRO researchers to growers may have been affected because of Monsanto funding and agreements. Also to be considered is the long term implications of these agreements on the direction of research, control over genetic material and the nature of the relationship between growers, researchers and technology owners/providers. The move from largely public and grower funded programs towards largely private or corporate funding will change these relationships as growers have indicated from the INGARD(R) experience.

The cost of the technology through the license fee is a major issue. The commercial considerations of pricing are not known. How Monsanto arrived at the price and how much goes to each party is not public information. Why the price in Australia is so much higher than in the USA angered most growers. Based on experience in other industries the implications of this do not favour growers. An example is the use of growth hormones in pig production. Initially, the first growers to use the product obtained an advantage. Once the industry as a whole adopted the practice, it became a necessity and no advantage accrued to growers but a new cost benchmark had been set for the industry which growers were locked into to remain competitive. INGARD(R) could to do this for cotton. Similarly, alternative new technology such as another transgenic or new chemical group has a price expectation established. A raised cost threshold for growers is a disadvantage. Growers could reject the use of the technology largely on price through cost/benefit analysis or use it very selectively to meet specific needs - thus limiting the impact on the industry overall.

Extra costs associated with growing INGARD(R) and compliance with the license requirements are issues in use. The extra crop checking by consultants at no extra charge did not please consultants. This will result in increased costs to growers when this problem is addressed. Cost associated with refugia did not seem to be a problem, the area grown was small at this stage. Compliance with the license was raised as a problem. The post crop cultivation was the main concern because it was difficult to fit into other operations.

The perception that growers funds helped in the development of this technology was strong and these growers felt cheated by the lack of information and the price charged. The actual situation with regards to grower and public funds needs to be clarified because this could affect growers attitudes towards funding in the future (and hence their own contribution). The majority of growers felt they should not contribute to research which, when commercialized, is beyond their control.

Understanding the rights and obligations of the licensing requirements is an area where many growers could do with some guidance. This is an area where, say Monsanto and Cotton Australia, could put together an information package or similar to inform growers.

Growers indicated caution towards alternatives, both similar to INGARD(R) and conventional. Most opted for lower cost and only after full evaluation. This probably reflects some of the problems experienced with INGARD(R) this season. Growers would prefer a choice in the marketplace for all types of technology.

The benefits to the environment, the community and the public from INGARD(R) usage attracted many comments with diverse views. Many growers are prepared to pay some added cost for environmental benefits but this has to be within the profitability sphere. Conducting a public relations campaign through the media on benefits accruing to the public is not a good way to convince growers they should pay a premium for something.

Economics

It is difficult to evaluate the economics of INGARD(R) based on one season. The information gathered in this survey was inadequate due to the structure of the questions asked. However, based on yields of the first seasons results, INGARD(R) scored poorly. Five out of 19 growers indicated equal or better yield from INGARD(R) compared to conventional. The rest were lower, some clearly uneconomic. Some of this could be attributed to lack of experience with the crop and the fact that some growers achieved good results indicates that INGARD(R) crops can yield well. The actual costs at comparable yields would hinge on the number of sprays required and the cost of each spray. One grower indicated 5 sprays were needed on his INGARD(R) crop.

The value guarantee seemed to be a confusing instrument and would not compensate for low yield. The high price charged for an 'experimental' crop angered growers because there was no way to recoup losses if it failed to perform. Based on yield, some growers sustained significant losses by growing INGARD(R). Whilst many growers were disappointed with INGARD(R)'s performance, the season in general was not easy and most will continue to trial the crop.