The farm level impact of GM crops in Europe:Bt maize in Spain & Roundup Ready soy in Romania

16 September 2006

Antalya, Turkey

Graham Brookes

PG Economics Ltd

Report coverage

- Domestic crop production, GM plantings, pest & weed problems & conventional control
- Impact of technology at the farm level: yields, costs of production, income
- Possible national level impact and impact on the environment
- Full copies of research papers available on www.pgeconomics.co.uk

Crops production base

Soy in Romania

- 130,000 ha – 3rd largest producer in Europe
- RR soy grown since 1999. Accounts for 2/3rds of total crop (87,000 ha)

Maize in Spain

- 440,000 ha – 3rd largest EU 15 producer
- Bt maize grown since 1998. Accounts for 11% of total crop (50,000 ha)

Sources: EU Commission, Coceral

Corn borer pressure in Spain

- Corn borer is main insect pest of maize in Spain
- Incidence varies by region and year – affected by climate/weather and planting times
- All regions where bt maize is planted are regions with medium to high levels of annual corn borer pressure/infestation levels
- similar pattern of usage found in the US

Weed problems in Romania

- Major problem affecting yields and harvest downgrading
- Problem linked to limited herbicide use since 1990 – economic transition difficulties, led to establishment and build up of weeds difficult to control (eg Johnson grass)
- Few farmers apply full recommended number of sprays (low profitability)

Corn borer: conventional treatment

Treatment with insecticides

- Based on chlorpyrifos or synthetic pyrethroids
- 6% -20% of the Spanish crop treated annually
- Treatment by aerial spraying or via irrigation (chlorpyrifos only)
- Cost of treatment: 18-24 euros/ha treated via irrigation, 36-42 euros/treated ha via aerial spraying

No use of insecticides (ie, no active policy)

- 80% plus of total crop receives no treatment (35% of crop in low infestation regions)
- Similar pattern to US: 5% of Corn Belt estimated to be treated

Corn borer conventional treatment: continued

Why limited use of insecticides ?

- Insecticides effective only at spray time & shortly after – corn borer hatching rarely obliges on timing & egg laying can last 3 weeks
- ineffective against borers that have already bored into stalks
- Possible adverse effect on beneficial insects that control spider mites
- Need to get spray time right – requires frequent crop walking – not always possible
- Perceived cost/treatment is high relative to effectiveness
- Some farmers do not realise level of yield damage inflicted by corn borer
- Corn borer pressure varies – can be limited some years

Corn borer and weed impact

Corn borer

- Huesca/Lleida regions: 10%-40% yield loss possible – annual average 15% yield loss if no insecticide used
- Huesca/Lleida regions: 10% yield loss on average even if insecticides used
- Yield loss across the country: probably -5% to -7%
- Some farmers perceived to be prepared to accept 3%-6% loss before considering conventional control methods – US evidence

Weeds

- Yields considerably lower: 30%-40% loss especially if 3-4 spray runs not used

Nature of GM crop user

Bt corn

- 50 hectare farms, planting 30 hectares of maize
- Most plant 4-5 varieties – one of which is Bt
- Average yield before use is 10 t/ha
- Many in high infestation areas have previously used insecticides
- All irrigated

RR soy

- Average = 500 ha farms, planting 100-125 ha soybeans (80% plus to RR)
- All irrigated crop growers

Bt use: impact on maize yield

- Sarinena region: +10% on yield where insecticides previously used over last 4 years & +15% where no treatment previously used
- 1997 trial results across the country: +6.3% on yield
- Barbastro area: low/medium infestation region: +1% to +1.1% yield average over last 4 years

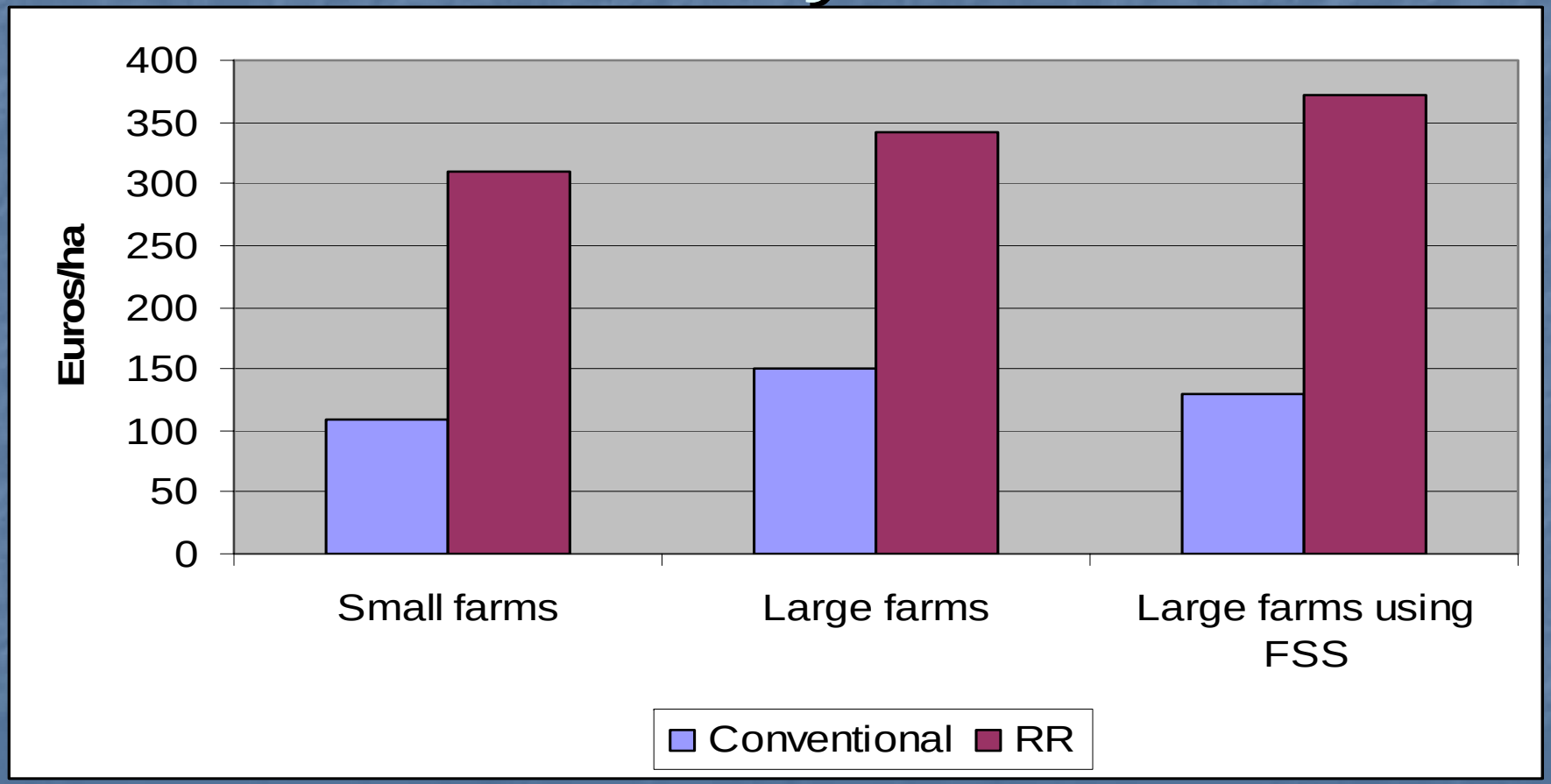
RR impact on soy yield

- +0.4-1 tonne/ha (+16% to +50%). Av = +31% on base yield on 2-2.5 tonnes/ha
- Gives better weed control eg, Roundup kills Johnson grass weed (not due to improved vigour of seed)
- Better harvest yield quality = +2% to +3% on price received

Impact on profits & costs: Bt maize

	Barbastro	**Sarinena range**	**Sarinena- av**
Average yield (tonnes/ha)	13-15	10	10
Yield gain from using Bt maize	+0.15	+0.5 to +2.0	+1.0
Revenue gain	+18.5	+61.5 to +246	+123
Quantifiable cost changes			
Seed cost	-18.5	-18.5	-18.5
Crop protection cost	No change	+24 to +102	+42
Net balance	Nil	+67 to +329.5	+146.5

Impact on costs and profits: RR soy



Impact on costs and profits: RR soy

- Cost of technology: +55.5 euros/ha farms up to 5,000 ha, +40 euros/ha farms over 5,000 ha
- Cost saving 28% on variable costs for farms over 5,000 ha, 29% farms under 5,000 ha
- Gross margin improvement: farms under 5,000 ha +200 euros/ha, farms over 5,000 ha +191 euros/ha, farms using farm-saved GM seed +241 euros/ha

Other impacts & issues

- Insurance benefit: a production risk management tool
- Convenience benefit: less time crop walking/spraying
- Small saving in energy costs and fuel (tractors)
- Improved quality: lower mycotoxin levels (maize), cleaner soy crop
- Reduced risk of human exposure to insecticides & herbicides
- Yield improvements in follow-on crops in Romania (improved weed control)
- Environmental benefits associated with lower levels of insecticide use & switch to more environmentally benign herbicides
- Is a technology used by & benefiting small farmers in Spain and available to all sizes of commercial farms in Romania
- Crops sold via normal marketing channels (to feed sector in Spain– no active segregation)

National level impact

Cumulative impact since first used to 2005	**Bt maize: Spain**	**RR soy: Romania**
Increase in farm income	+€24 million	+€53 million
Change in insecticide/herbicide active ingredient use (kg)	-34% (-240,000 kg)	+3% (+29,000 kg)
Change in environmental impact (as measured by an environmental impact quotient)	-30%	-4%

Concluding comments

- Benefit of the technology varies with level of corn borer & weed problems = varies by region and year
- Offers substantial benefits to some farmers but of marginal benefit to others = not a technology for all farmers
- Main benefits to the farmer; higher yield, improved farm profitability, convenience, risk management and less exposure to insecticides
- Main benefits to society: contribution to lower costs/real prices, improved grain/product quality (less mycotoxins) and environmental benefit of less insecticide use or switch to more environmentally benign herbicides