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Initial farmer perceptions on pasture cropping in the Northern Agricultural Region of Western Australia

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EverCrop WA

Initial farmer perceptions on pasture cropping in the Northern Agricultural Region of Western Australia

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Summary

Pasture cropping is an agricultural production system that combines annual crops and perennial plants with complementary growth and development cycles. The viability of this system (sowing winter-active crops into summer-active perennial pastures) is being evaluated in the Northern Agricultural Region of Western Australia by the Future Farm Industries CRC's EverCrop project because of its potential environmental and production benefits compared to cropping systems based solely on annual species. This report captures the initial perceptions of WA farmers on the advantages and constraints of pasture cropping. It also highlights information that farmers think is necessary to consider before adopting a pasture cropping system.

Facilitated discussions with innovative growers and industry representatives suggested that pasture cropping had a potential role to play in WA. Advantages perceived by farmers relate to increased profitability and improved soil health, including increased organic matter, microbial activity, nutrient levels from recycling, and improved soil structure. The potential constraints relate to the cost of establishment, reduced water availability for crop production and, in turn, potential yield losses.

Farmers require more information on the impact of pasture cropping on crop yield, grain quality and whole-farm profitability; and technical detail on crop, pasture and livestock management practices for different pasture cropping systems. The thirteen WA farmers who attended the first EverCrop Local Adaptation Group meetings indicated that they have a very positive view of pasture cropping systems but require more information and skills to assist them with adoption.

Background to target region

The medium rainfall zone of the Northern Agricultural Region (MRZ, NAR) covers 2.45 million hectares. Local government authorities in this region include Northampton, Chapman Valley, Mingenew, Irwin, Three springs, Carnamah, Coorow, Moora, Dandaragan and Victoria Plains (van Gool *et al.* 2008). This region is dominated by broadacre cereal cropping, based around wheat in rotation with narrow-leaf lupins and canola. The region is highly susceptible to wind erosion, due to a high proportion of sandplain soils, and there are mounting concerns with the sustainability of continuous cropping. This is because of expectation of drier winters and more frequent droughts in the future, rapidly increasing fertiliser costs, and concerns about soil fertility and weed problems including herbicide resistance. With more variable seasons there is increasing emphasis on risk management and a call for lower-input, lower-cost cropping systems.



Rhodes grass-dominant sward on erosion-prone sandplain soil at Murray Carson's property of West Binu in July 2010

Introduction

The Future Farm Industries Cooperative Research Centre (FFI CRC) seeks to increase the profitability of crop and livestock enterprises by increasing the extent and performance of perennials in mixed farming systems. Some innovative growers and extension specialists in the NAR have identified subtropical grasses as the most promising option to increase the perennial component on mixed crop-livestock farms (particularly on soils marginal for cropping) and pasture cropping as a potential system to continue grain production. This system involves planting an annual crop into a living summer active perennial pasture. It is underpinned by complementary growth periods between crop and pasture species grown together on the same ground at the same time.

Pasture cropping systems based on native perennial grasses or lucerne have been adopted in several grain producing regions of Australia. However, pasture cropping across subtropical perennial pastures is a new concept. Subtropical perennial pastures were introduced to the NAR of WA over 10 years ago. Some of these subtropical species (especially panic and Rhodes grass) have become an important component of livestock systems because they have proved to be the best perennial pasture option for pale deep sandy soils. However, there is uncertainty among researchers and growers about the viability of pasture cropping in WA because of the lack of agronomic research and credible on-farm demonstrations.



Tim Wiley (Ex-DAFWA staff) was the main driver to the introduction of subtropical grasses to the NAR. Tim on a sward of panic and Rhodes grasses at Murray Carson's property west of Binnu in Aug. 2009

Over the next three years (2008–11) personnel with the FFI CRC's Evercrop project will work closely with innovative growers in the MRZ of the NAR in WA to evaluate the viability of pasture cropping systems and their potential role to improve profits, diversify enterprises and provide positive environmental impacts.

Engagement with farmers to determine their perceptions on pasture cropping and information needs is an essential step to develop the system and identify constraints to adoption. This report draws on three sources to explore these issues:

- feedback from a seminar given at the annual Grower Group Alliance (GGA) forum
- a survey of consultants about annual and perennial pastures and
- feedback from a survey of Local Adaptation Group (LAG) members (two regional groups— 'Mingenew-Binnu' and 'Moora'—established by the EverCrop team with farmers interested in pasture cropping).

This discussion paper will also benchmark the knowledge, attitudes, skills, aspirations and perceptions (KASAP) of the LAG farmers in relation to the role of pasture cropping in integrating perennials into cropping systems.



David Ferris, EverCrop WA project manager (right), with Moora Local Adaptation Group discussing pasture cropping trial at Chris Vanzetti's property in Nov. 2009

Grower Group Alliance Forum

A seminar on pasture cropping was presented at the GGA's Grower and Researcher Annual Forum on the 14 August 2008 and feedback was obtained from the audience through a facilitated discussion around two questions.

(1) Is pasture cropping likely to be a viable technology to integrate perennials into cropping systems in WA?

Overall, the responses indicated that pasture cropping is a potential innovation for grain and livestock farming systems that could increase the utilisation of farming land as well as help adapt to climate variability, reduce input costs and increase soil organic matter (Appendix A).

The reasons why farmers perceive pasture cropping as potentially viable are that:

- it could give better cash flow over the long term
- it seems easy to integrate
- it reduces fertiliser inputs and
- it results in better waterholding capacity as well as less runoff and salinity.

The challenges are that:

- many farmers do not see the value in having livestock
- there is potential for pasture pests and diseases to impact on the crop.

(2) What research and extension activities would be most useful to test and integrate the concept of pasture cropping into current farming systems?

There were a few responses inquiring about how the technology would be used—if it would be used opportunistically or on an ongoing basis and the influence of soil water availability outside and during the growing season on this decision (Appendix A). Other questions raised were: should it be a low or high input system, can it reduce nitrogen inputs and what is the best row spacing of the crop relative to the pasture.

Farmers also require information on economic and environmental benefits for different soil types and rainfall zones, which perennials to grow and disease issues. In terms of extension, participants felt that there is a role for on-farm demonstrations, agronomic packages (including economic data) and utilising farmers who have experience in the technology.

Consultant survey

Thirty two consultants responded to an on-line survey on pastures including perennial pastures. Three of these consultants had clients in the NAR; two of them had been promoting subtropical perennial pastures and thought that perennial grasses have had extensive promotion in their region. The other consultant had not promoted subtropical pastures and thought that there had been little exposure to subtropical species in the region. The number of clients of the three NAR consultants who had adopted subtropical grasses was < 5, 6–10 and 11–15 per cent. All three consultants believe there is potential for 5–25 per cent of their clients to adopt subtropical perennial pastures.

More generally there were seven consultants out of 31 with more than five per cent of their clients who are growing subtropical perennial species. The main reasons why the farmers were growing subtropical perennial pastures (21 consultants responding to this question) were because of out-of-season stock feed (86 %), soil erosion control (76 %) and system sustainability (38 %). The main problems are that they are difficult to establish (76 %) and the costs are perceived as too high (67 %). The main reasons consultants think farmers are holding back from adopting subtropical perennials were the perceptions that they do not fit in the farming system (90 %), the cost of establishment is high (76 %) and they are difficult to establish (33 %).

Local Adaptation Group Surveys

Methodology

In February 2009, two Local Adaptation Groups were established in the NAR to evaluate the concept of pasture cropping. These groups comprised innovative growers from Moora, Mingenew and Binu, local agronomists and EverCrop facilitators. Growers were asked to indicate the degree to which they agreed or disagreed with four statements about pasture cropping, using a continuous scale from zero to ten (Appendix B). Facilitated discussions were also held to identify and rank potential benefits, constraints and research needs. Each grower was asked to assign 3, 2 and 1 point to their top three issues. Collective scores were expressed as a percentage of the total number of points per group. There were some grouping of similar issues (Tables 2 and 3).

Results

Responses to the four statements about pasture cropping indicated that in general the farmers of the two groups lack the knowledge and skill to adopt pasture cropping (Table 1). The results also suggest that the Moora farmers require more information but are more confident than the Mingenew-Binnu farmers in having skills to adopt pasture cropping. The questions about aspirations and skills indicate that the Mingenew-Binnu farmers are very positive that pasture cropping has a place on their farm in the near future. The Moora farmers are also positive but are more watchful and require more information to be able to adopt pasture cropping within the next two years (Table 1). The large range in responses indicates that within the groups the members have diverse views on pasture cropping. The correlations between the questions and the area of perennials were not strong, with one exception. The 10 farmers who had subtropical grasses were more likely to believe that pasture cropping has a role on their farm (average of 0.9 out of 10 with 0 meaning they totally agreeing it has a role and 10 totally disagreeing) compared to the three farmers who did not have subtropical grasses (average 5.5).

Table 1. Average response to four statements about pasture cropping* ; and average area of perennials sown by members of two EverCrop Local Adaptation Groups.

Variables	Mingenew-Binnu	Moora
No. of participants	8	5
I have the information I need to adopt PC	6.2 (5-9)	7.4 (3-10)
PC has a role to play on my farm	1.5 (0-5)	2.6 (0-8)
I have the skills and experience I need to adopt PC	6.1 (1-10)	4.1 (1-8)
I plan to adopt PC within the next 2 years	1.1 (0-3)	5.1 (0-10)
Area of subtropical grasses (ha)	163 (0-364)	118 (0-240)
Area of tagasaste (ha)	83 (0-324)	30 (0-150)
Area of lucerne (ha)	0	60 (0-200)

* 0 = totally agree and 10 = totally disagree with the statement; the range in responses is given in parentheses

The main advantages of pasture cropping perceived by the farmers in both groups were improved soil fertility and increased carrying capacity or feed over summer (Table 2). Improved soil fertility included increased organic matter, microbial activity and nutrient levels from recycling and improved soil structure. The Mingenew-Binnu group also indicated that other advantages of pasture cropping were: two income streams, increased waterholding capacity and less non-wetting soils (Table 2).

The main disadvantages of pasture cropping perceived by the farmers in both groups were reduced water availability and the opportunity cost to establish a perennial which was mentioned by the Mingenew-Binnu Group (Table 3). Reduced water availability included less

moisture at seeding, less stored moisture from summer rainfall, crop yield loss and grain quality decline if the season is tight.

Table 2. Ranked advantages of pasture cropping by each Local Adaptation Group

Aspect	Advantages (some issues were identified but did not receive any votes)	% of total votes	
		Mingenew-Binnu	Moora
Soil health	Increased organic matter, microbial activity and nutrient level	30	47
	Reduced N leaching (capture and recycling)		10
	Increased waterholding capacity or less non-wetting *	11	
	Reduced lime requirement		
Livestock	Greater carrying capacity		27
	Longer growing season		10
	Green feed over summer *	18	
	Less supplementary feed		
Enterprise mix	Two income stream (crop and livestock) *	20	
	Tighter rotation		6
	Better pasture after crop		
Weeds	Weed suppression (winter & summer)	7	
	Herbicide tolerance of perennials		
NRM	Carbon credits	7	
	Ground cover (less erosion) *	7	
	Beneficial insect hosting environment *		
Number of farmers		8	5

* Factors raised by the Mingeneu-Binnu group only

Table 3. Ranked disadvantages of pasture cropping by each Local Adaptation Group

Aspect	Disadvantages (some issues were identified but did not receive any votes)	% of total votes	
		Mingenew-Binnu	Moora
Water availability	Yield loss	36	33
	Less moisture at seeding (moisture from summer rain) #		19
	Crop germination compromised	14	
	Grain quality decline (if tight season) #		
Costs	Dry inter-row (between perennials) #		
	Opportunity cost to establish perennial *	31	
Biomass	Need to suppress perennials (cost and resistance threat) *		
	Less perennial growth over summer #		11
	Perennial decline #		15
Livestock	Perennial persistence compromised (due to crop water use) #		
	Animal health issues (photosensitisation) #		11
	Requires livestock #		
Cropping logistics	Grazing strategy difficult due to paddock size #		
	Herbicide tolerance of perennial #		7
	Rough paddocks (poor trafficability if low perennial density) *	9	
	Need for disc machine or tramlining (especially Rhodes grass)		7
	Contamination of grain	5	
	Weediness of perennials (spread to better cropping soils) *		
Pests	Uneven seeding depth *		
	Slashing required if no livestock *		
NRM	Green bridge for disease and pests (like aphids)	5	
	Attraction of rabbits, kangaroos and mice *		
Number of farmers		8	5

* Factors raised by the Mingeneu-Binnu group only; # Factors raised by the Moora group only

LAG members indicated that they required information on the following issues to consider adoption:

- type of perennial to use, which included the risk of it not becoming a weed, competitiveness, herbicide tolerance in pasture and pasture cropping phase and persistence
- pasture management, including grazing strategy especially entering the cropping phase and chemical type and timing of a suppression spray
- nutrition budget required for the system, fertiliser type and placement
- crop and pasture establishment issues, including row width of perennial and crop, placement of crop seed in the inter-row or on crown, tine vs. disc, time of crop sowing, impact of pasture on crop germination
- disease and insect threats and fungicide treatments; does the pasture host disease and insects both beneficial and pests?
- type of crop species (barley, lupin or wheat) and variety (long- or short-season)
- weed spectrum and control and its impact on crop and pasture performance
- harvest sample contamination risk
- rotation: continuous, in/out or opportunistic
- performance of pasture cropping on different soil types



Perry Dolling, DAFWA staff (left), with members of the Moora Local Adaptation Group at Chris Vanzetti's EverCrop trial in March 2010

Discussion

The first step in using pasture cropping is to establish the perennial pastures (or summer growing annuals). Subtropical species are better adapted to the NAR compared to lucerne and temperate species. The consultant survey indicated that although only a small proportion of farmers grow subtropical perennials pastures in this region currently, there is potential to increase their adoption. Pasture cropping has the potential to overcome the perception that perennials do not fit into the farming system and increase the value of a perennial-annual system

without compromising the main benefits from subtropical pastures as a source of out-of-season feed and soil erosion control.

Feedback from farmers (GGA and LAG) indicates that they are looking for improvements in soil health and soil waterholding capacity and fertility. Farmers also see potential for pasture cropping to increase profitability and/or spread the risk as there are two income streams: a crop and green feed for livestock over summer. An important part of the EverCrop project is to examine the economics of the system including gross margins and whole-farm MIDAS modelling. Soil health improvements are generally long term and therefore are outside the scope of this project. Although there may be some possibility to examine the soil health of longer term perennial pastures on farms in the area.

One of the likely constraints to adoption is the potential for the perennial to reduce crop yields due to competition for soil moisture (LAG). The APSIM pre-experimental (biological) modelling indicated that the perennial will reduce crop yield. However there is evidence from pasture cropping systems with lucerne that this loss can be minimised using agronomic management techniques. The size of the loss and its overall impact on whole-farm profitability will very likely influence the level and extent of adoption.

Another possible constraint is the cost of establishment of subtropical perennial grasses (consultant survey and LAG). Part of this concern could be overcome if the pasture cropping system was more profitable compared to perennial only or the annual crop/pasture rotation system in the long term. Crop yields and competition are being studied in small-plot and on-farm EverCrop experiments established in 2008.

The survey of the level of knowledge and skill of the two LAG's have provided a baseline indicating that farmers do not have sufficient knowledge or skill to adopt pasture cropping. An important commitment of the EverCrop project is to generate this knowledge in close consultation with farmers and to the extent R&D results. The project's activities will target the information areas that members of each LAG requested.

Such information was similar to the research priorities determined in the literature review and pre-experimental modelling:

- establishing pastures and cereals
- managing competition at the start of the season
- spatial arrangement of the perennial v. the annual
- NRM benefits
- choice of perennial and
- valuing the pasture cropping system within the context of the paddock and whole farm.

In addition to the small-plot experiments, the EverCrop project is gaining information about pasture cropping from supplementary trials, detailed case studies (User Evaluations), MIDAS and APSIM modelling. The project team is also interviewing farmers who have trialed pasture cropping in other areas of the wheatbelt with lucerne and more recently with subtropical grasses. The information will be delivered via field days, workshops and written material. However, the most effective ways to deliver this information to farmers and next users (consultants) requires further study.

Conclusion

Pasture cropping has created interest in the NAR as a potential new farming system and there is sufficient interest for 13 farmers to attend a meeting to discuss the potential viability of the system. The EverCrop project has captured some of the potential advantages, constraints and information requirements of the technology. Further information is required on what crop yield loss farmers will accept and to what level the additional benefits can compensate for any yield loss. To consider the prospects of wider adoption within the region it would be useful to obtain the views of farmers who have not yet adopted subtropical pasture species.

Acknowledgement

Thanks go to Tim Wiley (former DAFWA Officer) and Phil Barrett-Lennard (Agri-Consultant) for helping to establish the two Local Adaptation Groups and facilitate the first group meetings; and the growers and Agribusiness representatives who contributed ideas via facilitated discussions.

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Appendix A. Feedback from the Grower Group Alliance's Grower and Researcher Annual Forum, 2008

1. From your point of view, is pasture cropping a viable technology to integrate perennials into cropping systems in WA?

Response/Thoughts	Why (reasons)
<p>Positive</p> <ul style="list-style-type: none"> • Potential applicability in livestock/cropping systems. People still wanting to run livestock in a grain enterprise • Yes, but the key question is 'does pasture cropping have an ongoing role in cropping systems or is it opportunistic'? • Definitely, a valuable option for farmers, especially those with the need to utilise the greatest portion of farming land possible, including out-of-season and climatic variation/changes/fluctuations • Low fertiliser inputs • Retains more organic matter • Opportunity to research water use efficiency of deep-rooted perennials (other than lucerne) and crops • Opportunity for alternative legumes and reduction of input costs <p>Challenge</p> <ul style="list-style-type: none"> • To engage farmers—need clear economic and environmental benefits • Need economic analysis of perennials on different soil types and in different systems. What is \$ return? • Many cannot see the value of retaining or introducing stock in their system • We need to know which perennials we need to grow • Is there a benefit from high input or low? • Challenge to overcome pests and diseases in established pastures (to reduce impact on crop yield) • Will we have a disease problem? • Don't spend money 'reinventing the wheel', use the people and their experience • Utilise the work already happening on farms throughout the country 	<ul style="list-style-type: none"> • Maybe better cash flow year to year • Better long-term yearly average return • \$ return and labour shortage, time, capital investment • Farmers with livestock in their system would be more responsive to trialling pasture cropping without significant change to current program • With today's high cost of fertiliser • Better soil waterholding capacity. Less runoff and salinity <ul style="list-style-type: none"> • Dependent on economic information and development of decision-making framework to assist growers in choosing where, when and why pasture cropping should be used • Is the system recommended as a rotational component or are the benefits/risks appropriate for ongoing use of this system?

2. (a) What research and extension activities would be most useful to test and integrate the concept of pasture cropping into current farming systems?
 (b) What would your group/organisation be interested in considering further?
 (c) What would your group/organisation be interested in committing to?

Additional research and extension activities	Why? (Reason)	Your group's interest	Your group's actions to follow up on this project
<ul style="list-style-type: none"> Economic data from these systems Capture this information from research On-farm demonstrations (later years) <ul style="list-style-type: none"> Crop into existing pastures <ul style="list-style-type: none"> Lowering nitrogen inputs into crops through legume fixation <ul style="list-style-type: none"> High and low rainfall trial sites Deep-rooted perennial <ul style="list-style-type: none"> Row spacing and using 2-cm sowing system Low input/no fertiliser 	<ul style="list-style-type: none"> Assist growers to understand implications of these systems Ability to visualise impact of different systems <ul style="list-style-type: none"> Adoptability advantages <ul style="list-style-type: none"> Environmental benefits <ul style="list-style-type: none"> Size of WA Cereal and perennial roots growing in different zones Moisture and sowing advantages Keep cost of putting crop in low 	<ul style="list-style-type: none"> Helping our members to utilise their asset to full potential <ul style="list-style-type: none"> Some of our members may like to host some paddock-scale work 	<ul style="list-style-type: none"> Involve the Evergreen Group

3. (a) What else needs to be done (that your group or organisation can't do) to assist grower decisions about the placement and management of perennials in their cropping system?
 (b) What other tools and approaches might be necessary?

Actions (including steps if necessary)	Person/group responsible	Follow up/accountability rests with
<ul style="list-style-type: none"> Explore waterholding capacity of pasture cropping, that is, management strategies: <ul style="list-style-type: none"> Pre-season In-season 	<ul style="list-style-type: none"> Research project team 	<ul style="list-style-type: none"> Research project team
<ul style="list-style-type: none"> Explore disease management implications of pasture cropping with emphasis on green bridge <ul style="list-style-type: none"> Modelling Field validation 	<ul style="list-style-type: none"> Research project team 	<ul style="list-style-type: none"> Research project team
<ul style="list-style-type: none"> Develop agronomy packages and economic thresholds to assist growers when considering pasture cropping systems 	<ul style="list-style-type: none"> Research project team 	<ul style="list-style-type: none"> Research project team

Appendix B. Feedback from Local Adaptation Group meetings

1. Participants

Mingenew-Binnu (18 Feb 09)	Moora (10 Feb 09)
Murray Carson, West Binnu	Rob Barrett, Gillingarra
Rowan Ford, Balla	Murray Green, Gingin
Michael & Kate Morrison, Mingeneu	David Isbister, Moora
Don Nairn, East Binnu	Brad Tonkin, Coomberdale
Keith Tunney, Dongara	Chris & Tracey Vanzetti, Moora
Jim Wedge, West Binnu	David Cameron, Elders
Sarah Knight, Mingeneu-Irwin Group	
Tony Rosser, Great Northern Rural	
David Ferris (DAFWA)	David Ferris
Tim Wiley (ex-DAFWA)	Tim Wiley
Phillip Barrett-Lennard (Agri-Consultant)	Phillip Barrett-Lennard

2. Evaluation of KASA among Adaptability groups members

Knowledge	I have the information I need to adopt pasture cropping
Attitudes	Pasture cropping has a role to play on my farm
Skills	I have the skills and experience I need to adopt pasture cropping
Aspirations	I plan to adopt pasture cropping within the next 2 years

Group	Member	Knowledge (Totally agree = 0; Totally disagree = 10)	Attitudes	Skills	Aspirations	Actual plantings in 2009 (ha)		
						Subtropical grasses	Tagasaste	Lucerne
Mingenew-Binnu	1	7	0	2.9	0.9	364	324	0
	2	9.1	0.4	9.5	0.4	50	0	0
	3	5	1	9.1	2.6	250	50	0
	4	5.5	3.1	8.9	1.2	110	0	0
	5	4.9	0	3.7	2	110	0	0
	6	6.9	0.8	6.7	0.3	280	150	0
	7	5.4	1.8	0.5	0.6	140	140	0
	8	5.7	5.2	7.6	0.5	0	0	0
Moora	1	7.4	0.3	1.4	0	150	0	0
	2	7.3	1.3	3.8	5	240	0	100
	3	3.3	0.3	2.5	2	200	0	0
	4	9.3	7.9	8.2	8.7	0	0	200
	5	9.6	3.4	4.5	10	0	150	0
Mingenew-Binnu Moora		6.2	1.5	6.1	1.1	163	83	0
		7.4	2.6	4.1	5.1	118	30	60
Region		6.6	2.0	5.3	2.6	145.7	62.6	23.1

3. Supplementary research suggested by members of the Local Adaptation Groups

3.1. Information sought in relation to the perennial pasture component

Aspect	Mingenew-Binnu	Moora
What perennial?	Perennial type	
Management	Grazing strategy (especially when entering the cropping phase)	Weediness of perennials Competition with crop Herbicide tolerance In-crop suppression
Persistence		Persistence under crop
Nutrition		Nutrition budget required for system
Logistics	Row width of perennial	Machinery compatibility
Disease		Hosting disease/insect (beneficial and pest)

3.2. Information sought in relation to the annual crop component

Aspect	Mingenew-Binnu	Moora
Grain crop	What crop and variety (long- or short-season)	What crop species (barley, lupin, wheat)
Crop establishment	Time of sowing Seed placement (on crown or inter-row)	Time of sowing Seed placement (on crown or inter-row) Impact on crop germination
Weeds		Weed germination Weed control (tolerance of pasture base) Impact on pasture phase (weed control)
Pasture management	Suppression spray (chemical and timing)	
Machinery	Tyne v. disc Row width	Sowing machinery Harvest sample contamination risk
Rotation G x E		Rotation (continuous, in/out, opportunistic) Performance on different soil types
Nutrition Disease	Nutrition – fertiliser type & placement Disease risk (fungicide seed treatments)	