





GRDC Grower Solutions Project Central Queensland

Research, Development & Extension Gap Analysis June 2015

Queensland Department of Agriculture and Fisheries

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Introduction

A RD&E gap analysis for Central Queensland (CQ) was conducted as part of the contractual requirements (Milestones 9, 10) of the GRDC Grower Solutions for Central Queensland project (DAQ170, 2011 – 2015). The objective of this exercise was three-fold:

- (a) Review and analyse industry priorities and/or production constraints (=issues) nominated by grain growers, agronomists and/or agribusiness professionals over the duration of the project
- (b) Identify subjects/topics have been or currently are the targets of a significant RD&E effort in CQ and elsewhere, and
- (c) Identify potential subjects/topics that are emerging or existing issues that can be or are likely to be, in the near future, significant constraints on productivity/profitability and therefore worthy of future RD&E investment.

Methodology

Data/inputs for the analysis were sourced from (i) grains industry issues/priorities covering all relevant subject areas of grain farming, collected over the operating period (= analysis period) of the project (January 2011 – December 2014), and (ii) participants from a series of eight (8) focus group meetings across all CQ cropping districts in June 2014.

Analysis of industry issues

A total of 594 individual issues were included in the analysis. Individual issues were tagged with a <u>subject</u> label that identified a particular farming macro-practice such as weed management, agronomy, technology, etc., a <u>topic</u> label that identified a micro-practice or provided a contextual reference which captured the crux of the problem and a <u>R/D/E/Other</u> label that identified it as a research and/or development and/or extension issue within a project-based delivery mechanism or it was perceived to be a legislative/regulatory problem (='Other').

Topic tags were assigned in one of two ways. For those issues that were specific in nature and referred to a particular problem, the topic tag captured the essence of the specific problem or constraint articulated by the proponent. For example, an issue such as "Efficacy for residual herbicides in fallows" was assigned a topic tag of "Residual herbicides." In the case of non-specific issues that were, in effect, broad statements of need and the proponent was either unable or unwilling to be more specific about the particulars of the problem or focus on a particular component of the larger problem, a number of relevant topic tags were assigned to that issue. For example, a broadly framed issue such as "Options for grass weed control" was assigned multiple tags of "Residual herbicides", "Knockdown herbicides", "Feathertop Rhodes grass" and "Sweet Summer grass", these being some of the main aspects of grass weed control in fallows.

The frequency of nomination (=score) of each subject and topic over the analysis period was used as a measure of its importance (=grower priority). In the majority of cases, but not always, the score also served as an indicator of current/past R/D/E investment in each subject/topic. Five experienced RD&E staff members from the project team were asked to provide individual ratings of each subject and its component topics with respect to its need for future investment, after taking into consideration existing and/or past R/D/E activity/resource allocation.

Analysis of problem weed species emerging or accelerating in importance

Each participant in the July 2014 focus group meetings was given a tabulated list of 18 weed species <u>other</u> <u>than</u> *Chloris virgata* (feathertop Rhodes grass - FTR) and *Brachiaria eruciformis* (sweet summer grass - SSG), commonly encountered on CQ farms (Table 1). FTR and SSG were excluded from the list in recognition of their current importance and pest status, and being the targets of significant R/D/E in the last five years. The list was compiled from previous survey data provided by Queensland weeds researchers (Qld. Department of Agriculture) and other sources of information. Participants were asked to add additional weeds present on their farms to complete the list. Participants were then asked to identify which of the weed species on the tabulated list were present on their farms and indicate the proportion of farm cropping area infested and the level of difficulty of control (on a scale of 1= easy, to 5=hard) for each species. Responses of 55 participants (51 farmers and 4 agronomists) from eight meetings were included in this analysis.

Common name	Scientific name
African turnip	Sisymbrium thellungii
Barnyard grass	Sisymbrium crus-galli
Fat hen	Chenopodium album
Fleabane	Conyza bonariensis
Marshmallow	Malva parviflora
Mexican Poppy	Argemone ochroleuca
Milk (sow) thiste	Sonchus oleraceus
Native jute	Corchorus trilocularis
Parthenium	Parthenium hysterophorus
Polymeria pusilla	Polymeria pusilla
Rhynchosia	Rhynchosia minima
Sesbania	Sesbania cannabina
Tridax Daisy	Tridax procumbens
Variegated thistle	Silybum marianum
Vines (bell, Cow)	Ipomoea plebeia
Wandering Jew	Tradescantia fluminensis
Wild gooseberry	Physalis angulata
Wild Sunflower	Verbesina enclioides

Table 1. Weeds species found in CQ grain farming areas included in the 2014 Grower Solutions Project survey of problem weed species emerging or accelerating in importance.

Results & Discussion

Section 1: Industry issues

Industry-nominated issues were separated into 13 unique subject categories (Table 2). The dynamics of subject areas provides a big-picture view of industry issues and trends over time. Over the analysis period the vast bulk of production issues were related to weed management followed by soil nutrient management and agronomy, as indicated by the subject score, which is reflective of industry priority. A second tier of issues grouped under disease management, technology and insect management is also clearly evident. The predominance of the weed management subject, with a score of 180, is reflective of the past economic importance of key grass weed species in CQ, particularly FTR and SSG in the first half of the analysis period. On the basis of average ratings, indicative of future importance for RDE investment, weed management is still very important but the largest gains are likely to be in the subject areas of soil nutrient management and agronomy, followed closely by technological advances. The placement of extension in the top half of the ratings column warrants special mention due to the importance of extension activities in underpinning adoption and practice change. The remainder of this section will focus on the top three subject areas – Soil nutrient management, Agronomy and Weed management.

Cubicat	Cubicat coore	Priority for future RDE in CQ - individual					ratings
Subject	Subject score	#1	# 2	# 3	# 4	# 5	Average rating
Soil Nutrient Management	137	13	13	13	13	13	13
Agronomy	93	12	12	12	11	12	12
Weed Management	180	11	11	10	12	11	11
Technology	46	10	10	11	8	10	10
Extension	9	9	7	7 5	7	8	7
Farming System	9	4	4	8	10	9	7
New Crops	9	7	6	6	9	7	7
Disease Management	55	6	9	9	4	5	7
Economics	7	8	5	7	5	6	6
Insect Management	25	5	8	4	3	4	5
Feral Management	7	3	2	3	6	2	3
Policy	9	2	1	2	2	3	2
Soil Biology	6	1	3	1	1	1	1

Table 2. The frequency (=score) of production issues grouped within subject categories nominated by grain growers and agronomists in Central Queensland over the analysis period (2011-2014).

Priority	High						Medium						Low
Rating	13	12	11	10	9	8	7	6	5	4	3	2	1
Colour													
coding													

Soil nutrient management

A total of 35 topics were identified within this subject category (Table 3). A high priority designation for 'Critical values' is indicative of a research gap in relation to the accuracy and reliability of current soil diagnostics and crop responses, among other aspects, in relation to the soil reservoirs and dynamics of these macro elements. The underlying issue (Table 4) is a broad statement of need that highlights the importance of continuing the basic research on P, K and S whilst acknowledging recent GRDC investments in soil nutrient research in CQ. The second high priority topic, 'Demo trials - nutrients' reflects feedback from the grains industry indicating the need for more development/extension activities, particularly local onfarm trials, to supplement greater awareness of soil nutrient and fertility decline issues on their farms, due in part to the success of the CQ Grower Solutions project in showcasing elements of research outputs from

other GRDC funded programs (eg. Nutrient Management Initiative – Dr. Mike Bell). The macro nutrients, Sulfur being the foremost among them, follow closely behind in the priority ranking with medium priority tags, indicative of significant gaps in the current farmer and/or agronomist level understanding of their successful deployment in fertilizer programs to address perceived nutrient deficiencies.

Agronomy

The identification of 35 topics within this subject category, with 8 of those (15 issues) tagged as high priority with a predominantly research and/or development focus is indicative of the extent of the perceived R/D/E gap(s) and the nature/characteristics of the underlying issues. The call for new varieties that are specifically adapted to CQ production systems and growing conditions is a long standing one. At a more proximal and operational scale, management of stubble at planting is a problem that continues to grow in importance. Experienced agronomists and some of the best grain growers in CQ claim that the current industry practice in relation to crop layouts (not suitable for modern, high yielding varieties) and un-even plant stands are significant causes of unrealised yield potential. The rising cost of all fertilizers, particularly N, is a significant and ever increasing cost of production that will make low-cost alternative sources of N a very high priority for the future.

Weed management

A total of 41 topics were identified within this subject category. High priority designations for 'Residual herbicides' and 'Alternative residual herbicides' reflect significantly enhanced use of residual weed control products in recent years (2013, 2014) along with the need for increased training/guidance on their uses as stand-alone treatments and in conjunction with other tactics such as crop rotation programs, tillage and knockdown herbicides. A knowledge gap in relation to local (CQ specific) plant back and crop safety data for most residual herbicides has been long considered a high priority for future investment. A lack of options and/or guidelines for effective control of weeds, particularly grasses FTR and SSG, along fence lines, paddock edges and other non-cropped areas is viewed as a significant D/E gap and a weakness of IWM strategies that allows the weed species in question to rapidly recolonise treated areas. The first detection of a glyphosate resistant population of SSG in the Central Highlands in 2014 is a strong indicator of the need for more targeted extension of best practice for managing weeds using herbicidal products. Whilst FTR and SSG continue to be important economic considerations, sow (milk) thistle, Mexican poppy and fleabane, to some extent, are increasingly prevalent in cropping areas and are perceived to be hard to kill weeds. More information on grain grower perceptions of these weeds (importance, prevalence, impact) can be found in the following section. The fast pace of technological innovation makes knowledge gaps in technical aspects of spray equipment setup a high priority for future extension activities.

Τa	able 3.	The fre	quency	(=score)	of production	issues	grouped	by topic	within	subject	categories	nominated
by	ı grain	growers	s and ag	gronomists	s in Central C	Queensla	and over	the ana	lysis pe	riod (20	11-2014).	

Subject	Торіс		Priority for	RDE (%)	comp	onent	Other
		score	future RDE	R	D	E	(%)
Soil Nutrient Management	Critical values	14	3	100			
	Demo trials - nutrients	8	3		50	50	
	Sulfur (S)	41	2	11	26	63	
	Phosphorus (P)	40	2		32	68	
	Potassium (K)	38	2		42	58	
	Deep Placement	33	2		97	3	
	Formulations	24	2		33	67	
	Application techniques	23	2			100	
	Fertiliser budgets	20	2			100	
	Fertiliser management	19	2			100	
	Legume N	15	2			100	
	Timing	12	2			100	
	In-crop fertiliser	11	2			100	
	Soil test	10	2	8	17	75	
	Sap test	10	2	8	17	75	
	Soil test interpretation - research	6	2	50	50		
	Gross Margin	5	2			100	
	Grain proteins	3	2		50	50	
	Soil test interpretation-training/extension	2	2			100	
	Nitrogen (N)	30	1			100	
	Zinc (Zn)	12	1			100	
	Boron (B)	10	1		50	50	
	Micro nutrients	2	1		33	67	
	N tie up	2	1			100	
	Soil structure and health	1	1		50	50	
	Green Manure crops	1	1		50	50	
	Soil types	1	1		50	50	
	Crop rotation - extension	1	1		50	50	
	Soil Pits	1	1		50	50	
	Biological v Inorganic	1	1		100		
	Inoculation	1	1			100	
	Tillage	1	1			100	
	Biologicals	1	1			100	
	Crop rotation - nutrient management	1	1			100	
	Low yields	1	1			100	
Agronomy	New Varieties	14	3	78	17	6	
	Stubble management	12	3		45	55	
	Crop layouts - populations, spacing	7	3		50	50	
	Even plant stand	6	3	17	50	33	
	Low quality planting seed	4	3				100
	Planting date	3	3	50	50		
	N fixing cereals	1	3	100			

	Genetically Modified Crops	1	3		50		50
	Pre-harvest desiccation	12	2		25	50	25
	Varietal differences -shattering	6	2		50	50	
	Mungbean	3	2	38	38	25	
	Fallow rain efficiency	3	2	50	50		
	Mungbean shattering	3	2	50	50		
	Plant Growth Regulators	3	2	40	40	20	
	Lodging	2	2	50	50		
	Varietal differences	2	2	100			
	Irrigation	2	2	25	50	25	
	Seed vigour	2	2			100	
	Stubble distribution from header	2	2			100	
	Weathering tolerance	-	2	100		200	
	Munghean heat stress differences	-	2	100	50	50	
	Chicknes shattering	3	1		50	100	
	Stubble - fallow	2	1		67	33	
	Chicknoss	2	1		07	100	
		2	1			100	
		2	1			100	
	Seed treatments	2	1			100	100
	Planting seed	2	1	22	22	22	100
	Low yields	1	1	33	33	33	
	Green Manure crops	1	1	50	50		
	Desiccation - chickpea	1	1		100		
	Desiccation - mungbean	1	1		100		
	Desiccation - sorghum	1	1		100		
		-	T		100		
	Desiccation - maize	1	1		100		
	Desiccation - maize Organic	1 1	1		100	100	
Weed Management	Desiccation - maize Organic Residual herbicides	1 1 1 45	1 1 3		100	100 88	
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle	1 1 45 9	1 1 3 3		100 100 12	100 88 100	
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas	1 1 45 9 5	1 1 3 3 3		100 100 12 50	100 88 100 50	
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides	1 1 45 9 5 1	1 1 3 3 3 3 3		100 100 12 50 50	100 88 100 50 50	
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides	1 1 45 9 5 1 1	1 1 3 3 3 3 3 3 3		100 100 12 50 50 100	100 88 100 50 50	
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection	1 1 45 9 5 1 1 1	1 1 3 3 3 3 3 3 3 3 3 3 3		100 100 12 50 50 100	100 88 100 50 50 100	
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG)	1 1 45 9 5 1 1 1 1 45	1 1 3 3 3 3 3 3 3 3 2		100 100 12 50 50 100 20	100 88 100 50 50 100 70	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides	1 1 45 9 5 1 1 1 45 37	1 1 3 3 3 3 3 3 3 3 2 2 2		100 100 12 50 50 100 20 10	100 88 100 50 50 100 70 90	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock	1 1 45 9 5 1 1 1 45 37 19	1 1 3 3 3 3 3 3 3 2 2 2 2 2		100 100 12 50 50 100 20 10 50	100 88 100 50 50 100 70 90 50	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options	1 1 45 9 5 1 1 1 45 37 19 9	1 1 3 3 3 3 3 3 3 2 2 2 2 2 2	47	100 100 12 50 50 100 20 10 50 47	100 88 100 50 50 100 70 90 50 5	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy	1 1 45 9 5 1 1 1 45 37 19 9 8	1 1 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2	47	100 100 12 50 50 100 20 10 50 47 50	100 88 100 50 50 100 70 90 50 50 50	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition	1 1 45 9 5 1 1 1 45 37 19 9 8 8	1 1 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2	47	100 100 12 50 50 100 20 10 50 47 50 33	100 88 100 50 50 100 70 90 50 50 50 67	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management	1 1 45 9 5 1 1 1 45 37 19 9 8 8 8 8	1 1 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2	47	100 100 12 50 50 100 20 10 50 47 50 33	100 88 100 50 50 100 70 90 50 50 50 67 100	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants	1 1 45 9 5 1 1 1 1 45 37 19 9 8 8 8 8 8 4	1 1 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2	47	100 100 12 50 50 100 20 10 50 47 50 33	100 88 100 50 50 100 70 90 50 50 50 67 100 100	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds	1 1 45 9 5 1 1 1 1 45 37 19 9 8 8 8 8 8 8 4 3	1 1 3 3 3 3 3 3 3 3 3 2 <th>47</th> <th>100 100 12 50 50 100 20 10 50 47 50 33 50</th> <th>100 88 100 50 50 100 70 90 50 50 67 100 100 50</th> <th>10</th>	47	100 100 12 50 50 100 20 10 50 47 50 33 50	100 88 100 50 50 100 70 90 50 50 67 100 100 50	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds Crop herbicide injury	1 1 45 9 5 1 1 1 1 45 37 19 9 8 8 8 8 8 8 8 4 3 2	1 1 3 3 3 3 3 3 3 2 <th>47</th> <th>100 100 12 50 50 100 20 10 50 47 50 33 50 50</th> <th>100 88 100 50 50 100 70 90 50 50 50 67 100 100 50 50</th> <th>10</th>	47	100 100 12 50 50 100 20 10 50 47 50 33 50 50	100 88 100 50 50 100 70 90 50 50 50 67 100 100 50 50	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds Crop herbicide injury Application speed	1 1 45 9 5 1 1 1 45 37 19 9 8 8 8 4 3 2 2	1 1 3 3 3 3 3 3 3 3 2 <th>47</th> <th>100 100 12 50 50 100 20 10 50 47 50 33 50 50</th> <th>100 88 100 50 50 70 90 50 50 67 100 100 50 50 50 100</th> <th>10</th>	47	100 100 12 50 50 100 20 10 50 47 50 33 50 50	100 88 100 50 50 70 90 50 50 67 100 100 50 50 50 100	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds Crop herbicide injury Application speed Seed bank management	1 1 45 9 5 1 1 1 45 37 19 9 8 8 8 8 8 4 3 2 2 1	1 1 3 3 3 3 3 3 3 3 2 <th>47</th> <th>100 100 12 50 50 100 20 10 50 47 50 33 50 50 50</th> <th>100 88 100 50 50 70 90 50 50 67 100 50 50 50 50 100 50 100 50</th> <th>10</th>	47	100 100 12 50 50 100 20 10 50 47 50 33 50 50 50	100 88 100 50 50 70 90 50 50 67 100 50 50 50 50 100 50 100 50	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative nerbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds Crop herbicide injury Application speed Seed bank management Crop Rotation - weed impact	1 1 45 9 5 1 1 1 45 37 19 9 8 8 8 8 4 3 2 2 1 1 1	1 1 3 3 3 3 3 3 3 3 2 <th>47</th> <th>100 100 12 50 50 100 20 10 50 47 50 33 50 50 50</th> <th>100 88 100 50 50 70 90 50 50 67 100 50 100 50 50 100 50 100</th> <th>10</th>	47	100 100 12 50 50 100 20 10 50 47 50 33 50 50 50	100 88 100 50 50 70 90 50 50 67 100 50 100 50 50 100 50 100	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds Crop herbicide injury Application speed Seed bank management Crop Rotation - weed impact	1 1 45 9 5 1 1 1 45 37 19 9 8 8 8 8 8 4 3 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 3 3 3 3 3 3 3 3 2 <th>47</th> <th>100 100 12 50 50 100 20 10 50 47 50 33 50 50 50</th> <th>100 88 100 50 50 70 90 50 50 67 100 50 100 50 100 50 100 100 100</th> <th>10</th>	47	100 100 12 50 50 100 20 10 50 47 50 33 50 50 50	100 88 100 50 50 70 90 50 50 67 100 50 100 50 100 50 100 100 100	10
Weed Management	Desiccation - maize Organic Residual herbicides Milkthistle Fence lines and non-cropped areas Alternative herbicides Alternative residual herbicides Nozzle selection Grass Weeds (FTR and/or SSG) Knockdown herbicides Double Knock Novel control options Mexican Poppy Crop competition Resistance Management Adjuvants Broadleaf weeds Crop herbicide injury Application speed Seed bank management Crop Rotation - weed impact Spot spraying Seed vigour	1 1 45 9 5 1 1 1 45 37 19 9 8 8 8 8 4 3 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 3 3 3 3 3 3 3 3 3 3 2 3 <td< th=""><th>47</th><th>100 100 12 50 50 100 20 10 50 47 50 33 50 50 50</th><th>100 88 100 50 50 70 90 50 50 67 100 50 100 50 100 50 100 100</th><th>10</th></td<>	47	100 100 12 50 50 100 20 10 50 47 50 33 50 50 50	100 88 100 50 50 70 90 50 50 67 100 50 100 50 100 50 100 100	10

	Tillage	17	1		15	85	
	Fleabane	17	1			100	
	Water rates	8	1			100	
	Spray topping	6	1			100	
	Chemical antagonism	6	1			100	
	Alternative knockdown herbicides	5	1		83	17	
	Barnyard grass	5	1			100	
	Burning	3	1		100		
	Interaction effects	2	1	100			
	Volunteer cotton	2	-			100	
	Parthenium	- 2	-			100	
	Spray capacity	- 2	-			50	50
		2	-			50	100
	Demo trials	2	1		50	50	100
		1	1		50	50	
	Machanical cood dostruction	1	1		30	100	
		1	1			100	
	Spray drift	1	1			100	
		1	1			100	
	Tridax daisy	1	1			100	
	Volunteer mungbean	1	1			100	
Technology	Spatial analysis	9	3			89	11
	Even plant stand	5	3		29	71	
	Rain forecasting	4	3	100			
	Planters	2	3	50	50		
	Remote Sensing	2	3			100	
	N fixing cereals	1	3	100			
	Farm machinery tour	4	2			100	
	Robotics	2	2	50	50		
	Fallow rain efficiency	1	2	50	50		
	Crop Data Collection	1	2			100	
	Header fires	14	1		10	90	
	Tillage	1	1		50	50	
	Deep Wheel tracks	1	1			100	
	Grain Storage	1	1			100	
Extension	Spatial	1	3			100	
	Soil test interpretation	1	3			100	
	Spray drift	1	3			100	
	Resistance Management	1	3			50	50
	Genetically Modified Crops	1	3			100	
	Farm machinery tour	2	2			100	
	Extension	2	2			100	
	Demo trials	1	2		50	50	
Farming System	Lavout	2	3		33	67	
0 - 1	Crop Rotation - system impact	-	2			100	
	Crop Rotation	7	1		42	58	
	Organic	1	1		—	100	
		± 1	1			100	
l i i i i i i i i i i i i i i i i i i i		-	-			-00	

	Misc - soil structure	1	1			100	
New Crops	New Crops	14	3	35	65		
	New crops - better N fixing legume	1	3	100			
Disease Management	Puffy pod	14	3	100			
	New Varieties	5	3	100			
	Ascochyta Blight	13	2	25	25	50	
	Crown rot	8	2			100	
	Charcoal Rot	6	2	44	22	33	
	Fusarium	2	2	100			
	Powdery mildew	1	2		50	50	
	Sorghum lodging	1	2			100	
	Varietal differences	1	2			100	
	Yellow spot	6	1			100	
	Stripe Rust	4	1			100	
	Ergot	2	1			100	
	Fusarium head blight	2	1			100	
	Sorghum diseases	2	1			100	
	Diseases	2	1			100	
	Misc - mungbean	1	1		100		
	Wheat diseases	1	1			100	
Economics	Gross Margin	6	3			100	
	Debt	2	3		50	50	
	Compare practices	1	2		50	50	
	Benchmarking	1	2			100	
	Input costs	1	2			100	
	Organic	1	1			100	
Insect Management	Stored Grain Insects	13	2			100	
	Pod borer	3	2			100	
	Sorghum lodging	1	2			100	
	Cutworm	5	1			100	
	Armyworm	4	1			100	
	Heliothis	3	1			100	
	wireworm	2	1			100	
	Midge	2	1			100	
	Soil insects	1	1			100	
Feral management	Pigs	6	3			100	
	Birds	1	3	33		33	33
Policy	APVMA	5	3				100
	Birds	1	3				100
	Marketing	2	1			50	50
	Infrastructure	1	1				100
Soil Biology	Soil biology and health	5	2	100			
	Biology v inorganics	1	2	50	50		

Table 4. Production issues and their frequency (=score) grouped by topic within subject categories, nominated by grain growers and agronomists in Central Queensland over the analysis period (2011-2014).

			Issue	Future	RDE aspect				
Subject	Торіс	Production Issue	score	RDE priority	R	D	E	Other	
Soil Nutrient Management	Critical values	Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	14	High	100				
	Demo trials - nutrients	D&E on soil nutrient management (field walks, fertilizer trial demos, soil pit days, workshops for farmers and agros)	8	High	11	11	78		
	Sulfur (S)	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	19	Medium		27	73		
		Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium	30	35	35		
		Optimising yield/protein through split timing application of N and S (for summer and winter crops)	3	Medium			100		
		Demonstration of PKS fertilizer use to achieve economic response	3	Medium			100		
		Managing specific soil nutrient deficiencies - Sulfur in wheat	3	Medium			100		
		Nutrient limitations to summer crops especially mungbean - B, P & S	2	Medium			100		
		Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	2	Medium		50	50		
		Spreading vs. incorporation of N & S - info	1	Medium			100		
	Phosphorus (P)	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	22	Medium		24	76		
		Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium		50	50		
		Demonstration of PKS fertilizer use to achieve economic response	4	Medium		33	67		
		Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	2	Medium			100		
		Utilizing cracking soils to distribute P & K deep into the profile	2	Medium		50	50		
		Nutrient limitations to summer crops especially mungbean - B, P & S	2	Medium			100		

Potassium (K)	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	22	Medium	37	63
	Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium	50	50
	Demonstration of PKS fertilizer use to achieve economic response	4	Medium	50	50
	Utilizing cracking soils to distribute P & K deep into the profile	2	Medium	50	50
	Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	2	Medium	33	67
Deep Placement	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	20	Medium	100	
	Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium	100	
	Utilizing cracking soils to distribute P & K deep into the profile	2	Medium	100	
	More regular updates on Mike Bell's work	1	Medium		100
	Demonstration of PKS fertilizer use to achieve economic response	1	Medium	100	
	Impacts of tillage on nutrient stratification - info/extension	1	Medium	100	
Formulations	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	16	Medium	33	67
	Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	5	Medium	29	71
	Alternatives to granular fertilizer for NPKS (are they effective or efficient?)	2	Medium	50	50
	Better understanding of the risks and economics of N application form and timing in relations to PAWC and rainfall outlook	1	Medium		100
Application techniques	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	12	Medium		100
	Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium		100
	Spreading vs. incorporation of N & S - info	1	Medium		100
	Utilizing cracking soils to distribute P & K deep into the profile	1	Medium		100

	Information on economic N fertiliser application for maximizing yield and protein (N responses not as expected for N applied)	1	Medium	100
Fertiliser budgets	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	7	Medium	100
	Information on economic N fertiliser application for maximizing yield and protein (N responses not as expected for N applied)	6	Medium	100
	Collection and utilisation of grain proteins, yields and other crop information for future fertiliser strategies	2	Medium	100
	More reliable matching of nutrient types and nutrient amounts to soil water (diagnostics)	2	Medium	100
	Improve timing and application of nitrogen in relation to available soil moisture (extension)	1	Medium	100
	Better understanding of the risks and economics of N application form and timing in relations to PAWC and rainfall outlook	1	Medium	100
	Economics matrix for nutrients applied (Payback for investment in fertilizer)	1	Medium	100
Fertiliser management	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	16	Medium	100
	Collection and utilisation of grain proteins, yields and other crop information for future fertiliser strategies	1	Medium	100
	How to minimise N losses from traditional N fertilizer products	1	Medium	100
	Need to address general decline in soil fertility	1	Medium	100
	Focus on nutrients other than N	1	Medium	100
Legume N	N contribution of pulses in system (mungbean, chickpea)	9	Medium	100
	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	5	Medium	100
	Nutrition in mungbean - Value of adding N fertilizer	1	Medium	100
	Benefits of mungbean to following cereal crop - extension	1	Medium	100
Timing	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	8	Medium	100
	Preplant vs. planting application of N - info	1	Medium	100
	Getting fertiliser in crop / pre-plant for wheat	1	Medium	100

	Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	1	Medium			100
	Better understanding of the risks and economics of N application form and timing in relations to PAWC and rainfall outlook	1	Medium			100
In-crop fertiliser	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	6	Medium			100
	Optimising yield/protein through split timing application of N and S (for summer and winter crops)	3	Medium			100
	Timing of in-crop fertiliser applications (foliar, side dress) in relation to better prediction of rain fronts	2	Medium			100
Soil test	Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium	11	11	78
	When, what and how to request/use most appropriate nutrient testing procedures (soil, sap, tissue, etc)	2	Medium		33	67
Sap test	Continue long-term deep PKS R&D and develop more accurate critical values to diagnose nutrient deficiencies (soil, sap, tissue tests) and guidelines on how best to apply	8	Medium	11	11	78
	When, what and how to request/use most appropriate nutrient testing procedures (soil, sap, tissue, etc)	2	Medium		33	67
Soil test interpretation - research	More basic research, critical values of PKS , training on soil test interpretation	6	Medium	50	50	
Gross Margin	Demonstration of PKS fertilizer use to achieve economic response	2	Medium			100
	Economics matrix for nutrients applied (Payback for investment in fertilizer)	1	Medium			100
	Information on economic N fertiliser application for maximizing yield and protein (N responses not as expected for N applied)	1	Medium			100
	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	1	Medium			100
Grain proteins	Collection and utilisation of grain proteins, yields and other crop information for future fertiliser strategies	2	Medium		50	50
	Collection and utilisation of grain proteins, yields and other crop information for future fertiliser strategies	1	Medium		50	50
Soil test interpretation- training/extension	Better understanding of soil test interpretation and guides, basic understanding for farmers and detailed understanding for agronomists.	2	Medium			100
	_			1		

Nitrogen (N)	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	10	Low		100
	Information on economic N fertiliser application for maximizing yield and protein (N responses not as expected for N applied)	7	Low		100
	Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	3	Low		100
	Optimising yield/protein through split timing application of N and S (for summer and winter crops)	3	Low		100
	Nitrogen application in winter crops	1	Low		100
	Nutrition in mungbean - Value of adding N fertilizer	1	Low		100
	How to minimise N losses from traditional N fertilizer products	1	Low		100
	Preplant vs. planting application of N - info	1	Low		100
	Spreading vs. incorporation of N & S - info	1	Low		100
	Long term trials looking at OC rundown and replenishment	1	Low	50	50
	Low protein in wheat crops - info on economic N application for maximum yield and profitability	1	Low		100
Zinc (Zn)	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	11	Low		100
	Compare cost effectiveness of gas, liquids and granular fertilizers (N, P, K, S, Zn)	1	Low		100
Boron (B)	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	7	Low	50	50
	Nutrient limitations to summer crops especially mungbean - B, P & S	2	Low	33	67
	Possible Boron deficiency in mungbean in some areas (Callide/Dawson)	1	Low	100	
Micro nutrients	What are the most profitable strategies to manage micro nutrient deficiencies - including demo strip trials	2	Low	33	67
N tieup	How much nitrogen is being tied up by laying sorghum stubble flat versus left standing	2	Low		100
Soil structure and health	Hard setting soils - managing structure. How to manage loss of structure following flooding rains	1	Low	50	50
Green Manure crops	How to best use green manure crops to increase soil N, soil organic matter and improve fallow water efficiency (consider profits over 5 years)	1	Low	50	50

	Soil types	Better understand and manage soil nutrient availability and deficiency across cropping regions by soil type	1	Low		50	50	
	Crop rotation - extension	Benefits of mungbean to following cereal crop - extension	1	Low		50	50	
	Soil Pits	More nutrition D&E - More local fertiliser trial and soil pit field days	1	Low		50	50	
	Biological v Inorganic	More information about biologicals and how do they stack up compared to inorganic fertilisers	1	Low		100		
	Inoculation	Assessing nodulation responses of mungbean (water injection)	1	Low			100	
	Tillage	Impacts of tillage on nutrient stratification - info/extension	1	Low			100	
	Biologicals	Fertiliser costs - should we be making our own composts. How do we do it?	1	Low			100	
	Crop rotation - nutrient management	Use of crop rotation for nutrient management	1	Low			100	
	Low yields	Causes of low sorghum yields	1	Low			100	
Agronomy	New Varieties	Need more locally adapted varieties of wheat - long season, deep planting (longer coleoptile)	8	High	80	20		
		Need Ascochyta tolerant/resistant varieties for CQ	3	High	100			
		Agronomy of mungs/chickpeas with current/new varieties	1	High	33	33	33	
		Improved shattering quality in mungbean as good as if not better than 'Emerald levels'	1	High	100			
		Improved weathering tolerance in wheat varieties (low test wts + sprouting)	1	High	100			
	Stubble management	How to manage excess stubble (crop+weed) and trash flow at planting in ZT system	9	High		40	60	
		Will spraying urea on stubble encourage more rapid breakdown to minimise stubble flow issues?	2	High		67	33	
		Row spacing x yield comparisons in winter crops - what are the implications for stubble management?	1	High		50	50	
	Crop layouts - populations, spacing	More RD&E on optimising crop layouts all crops (plant densities, row spacing, etc)	7	High	7	47	47	
	Even plant stand	How do we get a more even plant stand in winter crops (seed placement technology) - develop a smoother travelling tyne and precision metering system (R&D)	4	High	14	57	29	
		What is the yield penalty (\$) from patchy plant stands compared to even plant stands	2	High	20	40	40	
	Low quality planting seed	Low establishment due to poor sorghum seed quality	4	High				100

Planting date	Understanding frost damage - more info on trade-off between early planting and frost risk	3	High	50	50		
N fixing cereals	From a UK study with N fixing bacteria in cereals, how can we get N from the air?	1	High	100			
Genetically Modified Crops	Feedback about GM products and what is in the pipe line	1	High		50		50
Pre-harvest desiccation	Current glyphosate label rates are ineffective - need registration of higher rates for mungbean and sorghum	3	Medium	50	50		
	Are new sorghum varieties drying down slower than old varieties?	2	Medium		50	50	
	Pros and cons of spraying out and timing of herbicide application for spray out - chickpeas	1	Medium			100	
	Need to generate CQ efficacy data for chemical registration - Category 26	1	Medium	50			50
	Off label herbicide use which is considered standard practice, residues may threaten markets	1	Medium	50		50	
	Determine the factors (genetic and environmental) that make some crops (i.e. mungbean and sorghum) harder to desiccate	1	Medium	100			
	Why do mungbean and sorghum appear harder to desiccate now than in the past (effect of stay green)?	1	Medium		50	50	
	Effective options for mungbean desiccation and spray-out	1	Medium	50	50		
	Improved desiccation strategies for sorghum/mungbean/corn/chickpea to quicken dry down	1	Medium		50	50	
Varietal differences - shattering	Increased shattering resistance in mungbean (relative to cv "Emerald") and chickpea varieties	6	Medium	8	50	42	
Mungbean	Mungbean agronomy research	3	Medium	38	38	25	
Fallow rain efficiency	How much more water could be store in a summer fallow if sorghum stubble is laid down compared to left standing	2	Medium	50	50		
	Is there a more efficient way to conserve and use our limited water	1	Medium	50	50		
Mungbean shattering	Do some varieties of chickpea and mungbean shatter more than others under weathering stress?	3	Medium	50	50		
Plant Growth Regulators	Look into plant growth regulators to slow down and manage growth of wheat (irrigation and dry land) - cost effectiveness	2	Medium	33	33	33	
	Options to plant wheat in March without early flowering (i.e. Breeding longer coleoptiles & growth regulators, maturity)	1	Medium	50	50		
Lodging	Standability of sorghum	2	Medium	50	50		

Varietal differences	Improved weathering tolerance in wheat varieties (low test wts + sprouting)	1	Medium	100			
	Are there mungbean varietal differences in establishment under extreme heat stress	1	Medium	100			
Irrigation	Improved crop yields under irrigation	2	Medium	25	50	25	
Seed vigour	Is there a difference in vigour between low and high protein wheat seed and large and small seeds?	2	Medium			100	
Stubble distribution from header	What is the yield benefit of evenly spreading harvest residues compared to less even spread	1	Medium			100	
	Is there a yield benefit to evenly spreading crop residues behind the header?	1	Medium			100	
Weathering Tolerance	Improved weathering tolerance in wheat varieties (low test wts + sprouting)	1	Medium	100			
Mungbean heat stress differences	Are there mungbean varietal differences in establishment under extreme heat stress?	1	Medium		50	50	
Chickpea shattering	Do some varieties of chickpea and mungbean shatter more than others under weathering stress?	3	Low			100	
Stubble - fallow	Barley wheat comparisons for stubble/yield	2	Low		67	33	
Chickpeas	Chickpea management to optimise production/yield - BMP for all aspects of crop	2	Low			100	
Inoculation	Greater knowledge and understanding of different legume inoculation practices (wet v's dry)	2	Low			100	
Seed treatments	What are the economics and efficacy of seed treatments in CQ (D&E)	2	Low			100	
Planting seed	Low vigour in winter crop seed 2011	2	Low				100
Low yields	Low sorghum yields	1	Low	33	33	33	
Green Manure crops	Long term (5 yrs) cost-benefit of green manure crops to increase soil N, OM and improve fallow water efficiency	1	Low	50	50		
Desiccation - chickpea	Improved desiccation strategies for sorghum/mungbean/corn/chickpea to quicken dry down	1	Low		100		
Desiccation - mungbean	Improved desiccation strategies for sorghum/mungbean/corn/chickpea to quicken dry down	1	Low		100		
Desiccation - sorghum	Improved desiccation strategies for sorghum/mungbean/corn/chickpea to quicken dry down	1	Low		100		
Desiccation - maize	Improved desiccation strategies for sorghum/mungbean/corn/chickpea to quicken dry down	1	Low		100		
Organic	More information on organic grain production and economic comparisons with conventional systems	1	Low			100	
 Residual herbicides	Options for effective control of FTR and SSG in fallows and in-crop (summer	23	High			100	

Weed

Management		and winter crops)				
		Plant back intervals for CQ following application of residual herbicides in winter and summer crops	4	High	43	57
		Options for fleabane control	2	High		100
		Chemical (residual, knockdown) and cultural (row spacing, population density) control of Mexican Poppy in chickpea	2	High	50	50
		Better knowledge, understanding of weed control strategies combining mechanical and residual herbicide options (IWM)	2	High		100
		Strategies to get consistently high efficacy from residuals	2	High		100
		Efficacy and safety of Dual Gold in Mungbean	2	High		100
		Seed sterilization of grass seed – FTR/SSG - use of fire/chemical/tillage x timing	1	High	50	50
		Does nozzle selection affect efficacy for residual products	1	High		100
		Can we use row spacing x plant population settings for more cost effective use of in-crop herbicides (all crops)?	1	High		100
		Metolachlor on chickpea (plant back/safety)	1	High		100
		Dual Gold in Mungbean	1	High		100
		Water rates – how low can we go to maintain efficacy of knockdown herbicides	1	High		100
		Efficacy and safety of Dual Gold in Mungbean + other residuals	1	High		100
		Machinery modifications to better incorporate residual herbicides	1	High		100
	Milk thistle	Management of milk thistle - herbicide options in fallow and in crop	8	High		100
		How to overcome logistics issues related to chemical antagonisms to manage Milk thistle in fields with multiple weeds	1	High		100
	Fence lines and non- cropped areas	Develop and extend suitable weed management strategies for fence lines and headlands	5	High	50	50
	Alternative herbicides	Options to control herbicide resistant weeds - alternative herbicides	1	High	50	50
	Alternative residual herbicides	Crop rotations to facilitate use of alternative herbicides for grass control	1	High	100	
	Nozzle selection	Nozzle selection - getting it right	1	High		100
	Grass Weeds (FTR and/or SSG)	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	33	Medium	3	97
		Seed sterilization of grass seed – FTR/SSG - use of fire/chemical/tillage x timing	1	Medium		100
		What to add to spot spray mixes to control new emergences around the FTR	1	Medium		100

	butt						
	Use of crop competition to control FTR	1	Medium			100	
	Info on soil/nutrition preferences of FTR? What makes it so successful?	1	Medium	50		50	
	Options for seed burial to stop germinations	1	Medium			100	
	Management strategy guide for FTR/SSG	1	Medium			100	
	Time to exhaustion of the seed bank for various weeds	1	Medium			100	
	Need to generate CQ efficacy data for chemical registration - Category 25	1	Medium		50		50
	Viability of FTR seed once hit by herbicide and/or fire	1	Medium		50	50	
	Off label herbicide use which is considered standard practice, residues may threaten markets	1	Medium			50	50
	How to get hot/effective burn on FTR seed/stubble reduction	1	Medium			100	
	Guidelines and options to manage resistance to Glyphosate in SSG	1	Medium			100	
Knockdown herbicides	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	17	Medium			100	
	FTR control in mungbean (Haloxyfop rates)	4	Medium			100	
	Glyphosate Label rates for use in summer fallows (especially for Fleabane control)	3	Medium			100	
	Group A herbicide management	3	Medium			100	
	Chemical (residual, knockdown) and cultural (row spacing, population density) control of Mexican Poppy in chickpea	2	Medium		50	50	
	Options for fleabane control	2	Medium			100	
	Current glyphosate label rates are ineffective - need registration of higher rates	2	Medium			100	
	What alternative knockdown herbicides can we use to control Feathertop Rhodes Grass (excluding verdict)	1	Medium			100	
	Water rates – how low can we go to maintain efficacy of knockdown herbicides	1	Medium			100	
	Seed sterilization of grass seed – FTR/SSG - use of fire/chemical/tillage x timing	1	Medium		50	50	
	How to manage impact of dust on efficacy of herbicide sprays using ground rigs	1	Medium			100	
Double Knock	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	11	Medium		50	50	
	How can spray operators reliably achieve Double Knock success on Feathertop Rhodes Grass and other weeds	2	Medium		50	50	
	Water rates and double knock timing of paraquat sprays	2	Medium		50	50	
	Options for fleabane control	2	Medium		50	50	

	Glyphosate Label rates for use in summer fallows (especially for Fleabane control)	1	Medium		50	50
	Water rates - how low can we go and provide consistent results for paraquat in a double knock	1	Medium		50	50
Novel control options	More R&D on weed control options which do not rely on chemicals or tillage (including microwave, fire, steam etc)	7	Medium	50	50	
	Non-chemical weed control options - What's out there?	1	Medium	50	50	
	Alternative (non-chemical) weed control options to manage herbicide resistant weeds	1	Medium	33	33	33
Mexican Poppy	Chemical (residual, knockdown) and cultural (row spacing, population density) control of Mexican Poppy in chickpea	7	Medium		50	50
	Mexican Poppy – management options – Chickpea and other broadleaf crops (non-phenoxy options)	1	Medium		50	50
Crop competition	Manipulate plant rows and populations to more profitably manage weeds (and reduce residual herbicide costs) in summer and winter crops	4	Medium			100
	Chemical (residual, knockdown) and cultural (row spacing, population density) control of Mexican Poppy in chickpea	2	Medium		100	
	Optimum settings for spray drift management and sprayer set up	1	Medium			100
	Non-chemical weed control options - What's out there?	1	Medium		50	50
Resistance Management	Development/Extension - Best practice for spray application and managing herbicides to prevent resistance development in CQ	5	Medium			100
	Training/Extension in weed management best practice for non-farmer spray operators (Council, rail, etc)	1	Medium			100
	Alternative (non-chemical) weed control options to manage herbicide resistant weeds	1	Medium			100
Adjuvants	Need a greater understanding about how to use adjuvants in weed control	2	Medium			100
	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	1	Medium			100
	Are the generics as consistent as brand name chemistry? In particular adjuvants	1	Medium			100
Broadleaf weeds	Best bet options for and IWM of broadleaf weeds	3	Medium		50	50
Crop herbicide injury	Crop damage from residual herbicides	1	Medium			100
	2-4,D damage in wheat managing Mexican poppy - how to limit damage	1	Medium		100	
Application speed	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	1	Medium			100

	How to maximize efficacy of chemicals including paraquat at a range of application speeds	1	Medium		100	
Seed bank management	Long term herbicide and cultural weed management on long term sites - long term trials	1	Medium	50	50	
Crop Rotation - weed impact	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	1	Medium		100	
Spot spraying	Weed-it/Weed-Seeker technology – economics and adaptability	1	Medium		100	
Seed vigour	Poor germ and/or low seed quality impacting on FTR abundance in sorghum	1	Medium			100
Tillage	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	9	Low		100	
	Better knowledge, understanding of weed control strategies combining mechanical and residual herbicide options (IWM)	2	Low		100	
	Chemical (residual, knockdown) and cultural (row spacing, population density) control of Mexican Poppy in chickpea	1	Low	50	50	
	Machinery modifications to better incorporate residual herbicides	1	Low	50	50	
	Use of disc chain in grass control	1	Low		100	
	What is the economic cost of tillage for weed control (system effects)?	1	Low		100	
	Non-chemical weed control options - What's out there?	1	Low	50	50	
	Need better understanding about the impacts (financial and environmental costs) of a tillage operation for weed control and its effects on the farming system	1	Low		100	
Fleabane	Best practice and chemical options for fleabane control in the system	8	Low		100	
	Fleabane management demo trials + extension	6	Low		100	
	Glyphosate Label rates for use in summer fallows (especially for Fleabane control)	2	Low		100	
	Urea and 2, 4 D spray mix for fleabane	1	Low		100	
Water rates	Water rates – how low can we go to maintain efficacy of knockdown herbicides	4	Low		100	
	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	3	Low		100	
	Water rates and double knock timing of paraquat sprays	1	Low		100	
Spray topping	How to destroy the seed/reduce seed viability of weeds with herbicides - Crop topping - rates, timing	6	Low		100	
Chemical antagonism	Develop options to takes out milk thistle and other BL weeds in a single spray - overcome glyphosate+phenoxy antagonism issues	5	Low		100	

		Wildcat [®] tank-mixing incompatibility issues	1	Low		100	
	Alternative knockdown herbicides	Alternatives to paraquat (as standalone product or in second knock)	2	Low	100		
		What alternative knockdown herbicides can we use to control Feathertop Rhodes Grass (excluding verdict)	2	Low	67	33	
		Crop rotations to facilitate use of alternative herbicides for grass control	1	Low	100		
	Barnyard grass	Barnyard grass control in fallow and in-crop	5	Low		100	
	Burning	How to get hot/effective burn on FTR seed/stubble reduction	1	Low	100		
		Viability of FTR seed once hit by herbicide and/or fire	1	Low	100		
		Seed sterilization of grass seed – FTR/SSG - use of fire/chemical/tillage x timing	1	Low	100		
	Interaction effects	Does declining soil fertility reduce weed susceptibility to herbicides?	2	Low	100		
	Volunteer cotton	Options to manage dryland cotton volunteers/ratoon cotton	2	Low		100	
	Parthenium	Options to manage parthenium coming through after a Verdict-paraquat double knock	2	Low		100	
	Spray capacity	What can be done to increase spray capacity in spraying to control weeds?	2	Low		50	50
	Legal	Generate CQ efficacy data for chemical / category 25 registration of key herbicide options	1	Low			100
		Chemical registration / category 25 registration of key herbicide options - remove red tape, make process faster	1	Low			100
	Demo trials	Fleabane control demos	1	Low	50	50	
	Atrazine	Broadleaf weed control with atrazine not satisfactory; atrazine not working well	1	Low	50	50	
	Mechanical seed destruction	Efficacy of mechanical weed seed destruction	1	Low		100	
	Spray drift	Guidelines for sprayer set up to manage spray drift	1	Low		100	
	Crop Rotation	Crop rotations to facilitate use of alternative herbicides for grass control	1	Low		100	
	Tridax daisy	Tridax daisy management - extension	1	Low		100	
	Volunteer mungbean	Management of germinating Mungbean post harvest	1	Low		100	
Technology	Spatial analysis	Better understanding and use of yield maps, satellite images and other remote sensing to identify and manage paddock variability	3	High		100	
		Need local technical support for precision agriculture	1	High			100
		Need local technical support for precision agriculture technologies	1	High		100	
		Economic analysis for use of yield maps and satellite images; when does it	1	High		100	

	become profitable?					
	Simplification of crop data collection and data management for growers. (Yield maps, biomass mapping, EM38 etc)	1	High			100
	More D&E of remote sensing technology (yield maps, satellite images, EM38, etc) to manage paddock variability	1	High			100
	More understanding and knowledge about using and benefits of yield maps + other layers	1	High			100
Even plant stand	How can we improve seed and plant placement (in the trench) for all crops + planter comparison activities	2	High		33	67
	R&D on seed placement technology (eg, smoother travelling tyne) to improve plant establishment and crop uniformity	2	High			100
	Better technology to reliably achieve even plant stand + \$ benefit of even plant stand	1	High		50	50
Rain forecasting	Need more accurate short and medium term weather forecasts (out to 4 months)	4	High	100		
Planters	Need for deep planting wheat	2	High	50	50	
Remote Sensing	Economic analysis of remote sensing tools; when does it become profitable in CQ?	1	High			100
	Better understanding and use of yield maps, satellite images and other remote sensing to identify and manage paddock variability	1	High			100
N fixing cereals	R&D on N fixing bacteria in cereals, how can we get N from the air?	1	High	100		
Farm machinery tour	Planter comparison activities - bus tours	1	Medium			100
	Header front (flex drapper, standard flex, conventional) comparison activities	1	Medium			100
	Bus tours & farm visits - tillage machinery trip; need tillage machinery more suited to CTF farming system	1	Medium			100
	Determine the difference in harvest efficiency between a flex draper and standard draper header in low growing legume crops	1	Medium			100
Robotics	Support R&D in Robotics and drone technology to enable new farming practices	1	Medium		100	
	Robots & drones - to enable new farming practices	1	Medium	100		
Fallow rain efficiency	Is there a more efficient way to conserve and use our limited water	1	Medium	50	50	
Crop Data Collection	Simplification of crop data collection and management for growers. (Yield maps, biomass mapping, EM38 etc)	1	Medium			100

	Header fires	Reducing the risk of header fires when harvesting chickpeas in low humidity conditions by using better harvest technology, breeding (lower acid) and crop factors	6	Low			100	
		Options to minimise header fires - new technology, header modifications, varietal choice and crop management	4	Low		20	80	
		Options (+ leaf drop) to minimise header fires including exhaust legging (ext)	1	Low			100	
		Reduce fire risk when harvesting chickpeas (Research)	1	Low	50		50	
		Develop methodology to predict high fire risk in headers based on weather parameters	1	Low			100	
		Predictive weather parameters (delta T figures) for high fire risk in headers	1	Low			100	
	Tillage	Machinery modifications to better incorporate residual herbicides	1	Low		50	50	
	Deep Wheel tracks	Management of wheel ruts caused by machinery operating on wet soil	1	Low			100	
	Grain Storage	More information about on-farm grain storage handling and grain protection - infrastructure, equipment	1	Low			100	
Extension	Spatial	D&E on how to use yield maps to increase productivity and profitability	1	High			100	
	Soil test interpretation	Nutrition training for agronomists - similar to the training that used to be supplied by Incitec	1	High			100	
	Spray drift	Spray drift management/education	1	High			100	
	Resistance Management	Better training of non-farmer spray operators (Council, rail, etc) to stop them breeding problem weeds and creating seed sources	1	High			50	50
	Genetically Modified Crops	Feedback about GM products and what is in the pipe line	1	High			100	
	Farm machinery tour	Planter comparison activities – bus tour	1	Medium			100	
		Bus tours & farm visits - tillage machinery trip; need tillage machinery more suited to CTF farming system	1	Medium			100	
	Extension	Options for effective control of FTR and SSG in fallows and in-crop (summer and winter crops)	1	Medium			100	
		Crop solutions (Crop notes 2012) Ute book	1	Medium			100	
	Demo trials	Demos and field days for current fertiliser trials + bus tours to other trial sites	1	Medium		50	50	
Farming System	Layout	Managing controlled traffic; contour banks, erosion control	2	High		50	50	
	Crop Rotation	Plant back intervals for CQ following application of residual herbicides in winter and summer crops	2	High		50	50	
		Crop rotation options for CQ and impacts of rotation	6	Low			100	

Organic ZT v till Misc - soil structure	More information on organic grain production and economic comparisons	1	Low			100
	What is the economic cost of tillage for weed control (system effects)?	1	Low			100
	Hard setting soils - managing structure. How to manage loss of structure following flooding rains	1	Low			100
New Crops	Evaluate suitable new crop options for CQ (legume and cereal)	11	High	43	57	
	Alternative (mungbean & chickpea) pulse crops for improved N and \$ returns	1	High		100	
	Trials on new/alternative/emerging crops	1	High		100	
	Info/guidelines for fitting alternative summer crop options such as soybean, sunnies into CQ crop rotations	1	High			100
New crops - better N fixing legume	Evaluate suitable new crop options for CQ (legume and cereal)	1	High	100		
Puffy pod	Better understanding, knowledge and solution to puffy pod in mungbean	14	High	100		
New Varieties	Ascochyta blight resistant variety for CQ	3	High	100		
	Sorghum varieties with better resistance/tolerance to Charcoal rot and Fusarium	1	High	100		
	Ascochyta resistant variety for CQ	1	High	100		
Ascochyta Blight	Ascochyta blight resistant variety for CQ	6	Medium	100		
	More extension to target farmers using sub-optimal practice for diseases such as Ascochyta blight	4	Medium			100
	Strategy to reduce interval between chickpea crops - disease management	1	Medium		100	
	Ascochyta Blight, does it have to be the issue it is?	1	Medium			100
	Develop Ascochyta Blight management guidelines (spray recommendations) to match "local" lower risk situations	1	Medium			100
Crown rot	Greater knowledge and awareness of management strategies for crown rot, yellow spot and stripe rust	2	Medium			100
	Management of Yellow spot/Crown rot in wheat - info for in-crop management	2	Medium			100
	Integrated management of Crown Rot in wheat	2	Medium			100
	Management strategies for crown rot, yellow spot and stripe rust	1	Medium			100
	Crown rot in wheat	1	Medium			100
Charcoal Rot	Options to manage lodging in sorghum (charcoal rot and other factors)	3	Medium	20	20	60
	Sorghum varieties with better resistance/tolerance to Charcoal rot and Fusarium	2	Medium	100		
	Charcoal rot research/development in sorghum	1	Medium	50	50	
	Organic ZT v till Misc - soil structure New Crops New Crops - better N fixing legume Puffy pod New Varieties Ascochyta Blight Crown rot Charcoal Rot	Organic More information on organic grain production and economic comparisons ZT v till What is the economic cost of tillage for weed control (system effects)? Misc - soil structure Hard setting soils - managing structure. How to manage loss of structure following flooding rains New Crops Evaluate suitable new crop options for CQ (legume and cereal) Alternative (mungbean & chickpea) pulse crops for improved N and \$ returns Trials on new/alternative/emerging crops Info/guidelines for fitting alternative summer crop options such as soybean, sunnies into CQ crop rotations New crops - better N Evaluate suitable new crop options for CQ (legume and cereal) fixing legume Evaluate suitable new crop options for CQ (legume and cereal) Puffy pod Better understanding, knowledge and solution to puffy pod in mungbean New Varieties Ascochyta blight resistant variety for CQ Sorghum varieties with better resistance/tolerance to Charcoal rot and Fusarium Ascochyta blight resistant variety for CQ Ascochyta blight resistant variety for CQ More extension to target farmers using sub-optimal practice for diseases such as Ascochyta blight, does it have to be the issue it is? 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How to manage loss of structure1New CropsEvaluate suitable new crop options for CQ (legume and cereal)11Alternative (mungbean & chickpea) pulse crops for improved N and \$ returns1Trials on new/alternative/emerging crops1Info/guidelines for fitting alternative summer crop options such as soybean,1sunnies into CQ crop rotations1New crops - better NEvaluate suitable new crop options for CQ (legume and cereal)1fixing legume1Puffy podBetter understanding, knowledge and solution to puffy pod in mungbean14New VarietiesAscochyta blight resistant variety for CQ3Sorghum varieties with better resistance/tolerance to Charcoal rot and Fusarium1Ascochyta BlightAscochyta resistant variety for CQ1Ascochyta BlightAscochyta legit faces it have to be the issue it is?1Develop Ascochyta Blight Goes it have to be the issue it is?11Develop Ascochyta Blight Goes and awareness of management strategies for crown rot, vellow spot and stripe rust21Ascochyta Blight Goes it nave to be the issue it is?11Develop Ascochyta Blight Goes it have to be the issue it is?11Develop Ascochyta Blight Goes it have to be the issue it is?11Develop Ascochyta Blight	Organic More information on organic grain production and economic comparisons 1 Low ZT v till What is the economic cost of tillage for weed control (system effects)? 1 Low Misc - soil structure Hard setting soils - managing structure. How to manage loss of structure 1 Low New Crops Evaluate suitable new crop options for CQ (legume and cereal) 11 High Alternative (mungbean & chickpea) pulse crops for improved N and \$ returns 1 High Trials on new/alternative/emerging crops 1 High Info/guidelines for fitting alternative summer crop options such as soybean, sunnies into CQ crop rotations 1 High New crops - better N Evaluate suitable new crop options for CQ (legume and cereal) 14 High Puffy pod Better understanding, knowledge and solution to puffy pod in mungbean 14 High New Varieties Ascochyta blight resistant variety for CQ 3 High Ascochyta blight resistant variety for CQ 6 Medium as Ascochyta blight Ascochyta blight close it have to be the issue it is? 1 Medium as Ascochyta blight Crown rot Greater knowledge and awareness of management strategies for crown rot, yellow spot and stripe rust Medium Management of Ye	Organic ZT v tillMore information on organic grain production and economic comparisons1LowZT v tillWhat is the economic cost of tillage for weed control (system effects)?1LowMisc - soil structureHard setting soils - managing structure. How to manage loss of structure1HighNew CropsEvaluate suitable new crop options for CQ (legume and cereal)11HighAlternative (mungbean & chickpea) pulse crops for improved N and \$ returns1HighTrials on new/alternative/emerging crops1High100New crops - better NEvaluate suitable new crop options for CQ (legume and cereal)1High100New crops - better NEvaluate suitable new crop options for CQ (legume and cereal)1High100Puffy podBetter understanding, knowledge and solution to puffy pod in mungbean14High100New VarietiesAscochyta blight resistant variety for CQ3High100Sorghum varieties with better resistance/tolerance to Charcoal rot and a Ascochyta blight resistant variety for CQ1High100Ascochyta BlightAscochyta blight management guidelines (spray recommendations) to1Medium Accohyta blight100Crown rotGreater knowledge and awareness of management strategies for crown rot, yellow spot and stripe rust1Medium MediumCrown rotGreater knowledge and awareness of management strategies for crown rot, yellow spot and stripe rust1Medium MediumCrown rotGreater knowledge and awareness of management s	Organic More information on organic grain production and economic comparisons 1 Low ZT v till What is the economic cost of tillage for weed control (system effects)? 1 Low Misc - soil structure Hard setting soils - managing structure. How to manage loss of structure 11 Higt 43 57 New Crops Evaluate suitable new crop options for CQ (legume and cereal) 11 Higt 100 Trials on new Alternative/emerging crops 1 Higt 100 Info/guidelines for fitting alternative summer crop options such as soybean, sunnies into CQ crop rotations 14 Higt 100 New crops - better N Evaluate suitable new crop options for CQ (legume and cereal) 1 Higt 100 Puffy pod Better understanding, knowledge and solution to puffy pod in mungbean 14 Higt 100 New Varieties Ascochyta blight resistant variety for CQ 3 Higt 100 Ascochyta Blight Ascochyta blight resistant variety for CQ 6 Medium 100 Ascochyta Blight Ascochyta blight resistant variety for CQ 1 Higt 100 Ascochyta Blight Ascochyta blight resistant variety for CQ 6

	Fusarium	Sorghum varieties with better resistance/tolerance to Charcoal rot and Eusarium	2	Medium	100	
	Powdery mildew	Powdery mildew – more options which work	1	Medium	50	50
	Sorghum lodging	Options to manage lodging in sorghum (charcoal rot and other factors)	1	Medium		100
	Varietal differences	Is there a difference in leaf disease susceptibility in sorghum varieties	1	Medium		100
	Yellow spot	Greater knowledge and awareness of management strategies for crown rot, yellow spot and stripe rust	6	Low		100
	Stripe Rust	Greater knowledge and awareness of management strategies for crown rot, yellow spot and stripe rust	4	Low		100
	Ergot	sorghum ergot management	2	Low		100
	Fusarium head blight	Fusarium head blight	2	Low		100
	Sorghum diseases	Is there a difference in leaf disease susceptibility in sorghum varieties	1	Low		100
		Better understanding of cereal diseases and management best practice	1	Low		100
	Diseases	Disease management in wheat/barley/chickpea	1	Low		100
		Disease management in various crops	1	Low		100
	Misc - mungbean	Crinkly leaf syndrome in mungs – impact on yield and control	1	Low	100	
	Wheat diseases	Better understanding of cereal diseases and management best practice	1	Low		100
Economics	Gross Margin	Develop guidelines for P, S & K & Zn applications to maximise yield for available N and water for CQ (economic rates of P, K and S - summer and winter crops)	1	High		100
		Economics matrix for nutrients applied (Payback for investment in fertilizer)	1	High		100
		Economic analysis of remote sensing tools; when does it become profitable in CQ?	1	High		100
		Cost Effective Nutrient management	1	High		100
		All trial results need to have economic data presented	1	High		100
		Costings for grass control – tillage and chemistry	1	High		100
	Debt	What is the effect of farm debt levels on productivity and technology uptake	2	High	50	50
	Compare practices	What is the economic cost of tillage for weed control (system effects)?	1	Medium	50	50
	Benchmarking	Benchmarking economic returns	1	Medium		100
	Input costs	Cost of Production - Economic analysis	1	Medium		100
	Organic	More information on organic grain production and economic comparisons	1	Low		100
Insect Management	Stored Grain Insects	Improved knowledge and understanding of grain storage insect control - plus new control options	5	Medium		100

		Improved knowledge and understanding of insect control options in stored grain	4	Medium		100	
		Grain storage - insect management	2	Medium		100	
		Improved knowledge and understanding of insect control options in stored grain, control options, chemicals	1	Medium		100	
		How to achieve reliable control of grain insects in storage (Phill Burril ext)	1	Medium		100	
	Pod borer	Insect control - Heliothis, sorghum midge, pod borer in mungbean	2	Medium		100	
		Bean pod borer thresholds	1	Medium		100	
	Sorghum lodging	Improved knowledge and understanding of grain storage insect control - plus new control options	1	Medium		100	
	Cutworm	Improved understanding and knowledge about soil insect, cutworm and army worm control	3	Low		100	
		What in-furrow treatment options do we have for cutworm and wireworm + seed treatment	1	Low		100	
		Improved understanding and knowledge about wire, cut and army worm control	1	Low		100	
	Armyworm	Improved understanding and knowledge about soil insect, cutworm and army worm control	3	Low		100	
		Improved understanding and knowledge about wire, cut and army worm control	1	Low		100	
	Heliothis	Insect control - Heliothis, sorghum midge, pod borer in mung beans	1	Low		100	
		Lack of chemical options for grub control other than Steward in sorghum	1	Low		100	
		Insect control - Heliothis, sorghum midge, pod borer in mungbean	1	Low		100	
	wireworm	What in-furrow treatment options do we have for cutworm and wireworm + seed treatment	1	Low		100	
		Improved understanding and knowledge about wire, cut and army worm control	1	Low		100	
	Midge	Insect control - Heliothis, sorghum midge, pod borer in mungbean	1	Low		100	
		Insect control - Heliothis, sorghum midge, pod borer in mung beans	1	Low		100	
	Soil insects	Options to manage soil insects	1	Low		100	
Feral management	Pigs	What are the most effective and economical Pig control options (ext)	6	High		100	
	Birds	Need viable options for bird control - law changes perhaps, permits	1	High	33	33	33
Policy	APVMA	Make agricultural chemical registrations and label changes easier, faster, more cost effective and responsive to industry needs	2	High			100

		How can industry overcome situations where herbicide labels are behind farmer practice Off label herbicide use - residues threat to markets	1	High High				100 100
		Make herbicide (pesticides) registrations and label changes faster and more cost effective	1	High				100
	Birds	Need viable options for bird control - law changes perhaps, permits	1	High				100
	Marketing	Breakdown of organised marketing	2	Low			50	50
	Infrastructure	poor road infrastructure	1	Low				100
Soil Biology	Soil biology and health	More RD&E on soil biology, soil health and nutrient management	5	Medium	100			
	Biology v inorganics	More information about biologicals and how do they stack up compared to inorganic fertilisers	1	Medium	50	50		

Section 2: Problem weed species emerging or accelerating in importance

The potential impact of weed species commonly encountered on CQ grain farms and regarded as being of some significance as current or future production constraints is summarised in Fig. (1). Milk thistle was found on a majority of participants' farms and on 50% of infested farms was estimated to be impacting on more than 80% of the cropping area. Other weeds of significance were Mexican poppy and fleabane, present at lower levels on a majority of farms, followed by Sesbania and African turnip.

The data on the prevalence and relative difficulty of controlling each weed species are summarised by cropping district (where focus group meetings were held) and for the whole of CQ (Figs. 2A-H, 3). From a whole of region perspective, milk (sow) thistle is clearly on the verge of being a significant production constraint, followed by fleabane and Mexican poppy which can be a serious problem but largely in chickpea. Differences amongst cropping districts with respect to weed species prevalence are clearly evident and largely expected, as being reflective of differences in soil types, cropping systems and other micro-climatic variation.



Fig. 1. Farm cropping area (%, median, max, min) infested by weed species in Central Queensland. Data source: Central Queensland Grower Solutions project focus group meetings, July 2014. Numbers represent the number of farms where the weed species was found.



Fig. 2. Weeds voted by growers from each of eight Central Queensland cropping districts as being the hardest to kill using currently registered herbicide options. The (%) figure for each weed represents the proportion of the total votes cast in each district. Data source: Central Queensland Grower Solutions Project – focus group meetings – June 2014. (a) Kilcummin – 25 votes; (B) Clermont – 30 votes; (C) Capella – 30 votes; (D) Gindie – 30 votes; (E) Rolleston – 30 votes; (F) Duaringa – 20 votes; (G) Jambin – 55 votes; (H) Moura – 55 votes.



Fig. 3. Weeds voted by growers from Central Queensland (eight cropping districts) as being the hardest to kill using currently registered herbicide options. The (%) figure for each weed represents the proportion of the total votes cast across districts (n=275 votes). Data source: Central Queensland Grower Solutions Project – focus group meetings – June 2014.