The adoption and diffusion outcome prediction tool

Adoption report for:

New perennial legume for low rainfall grazing

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Project Details

MODEL

Standard

YOUR INNOVATION

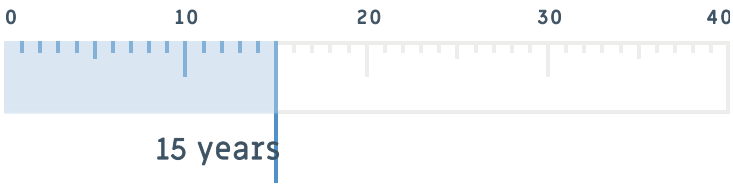
The new perennial legume species has been found to be more drought tolerant than lucerne and able to grow on soils where lucerne has failed in the past. It has slightly less feed quality than lucerne but offers greater groundcover in summer to protect soils from erosion.

YOUR POPULATION

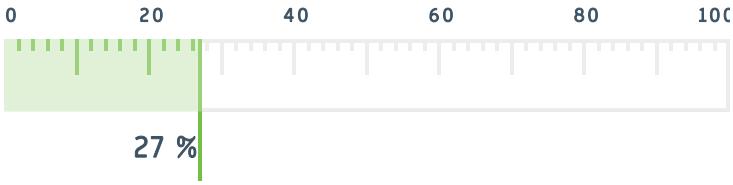
Farmers in the low rainfall cropping regions where lucerne can not be currently reliably grown who typically have both crop and livestock.

Adoption Level

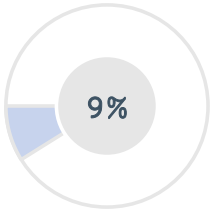
TIME TO NEAR-PEAK ADOPTION LEVEL
(years)



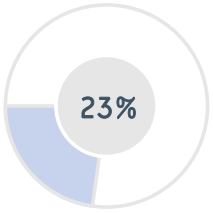
PEAK ADOPTION LEVEL
(percent %)



Predicted adoption levels



IN 5 YEARS FROM START



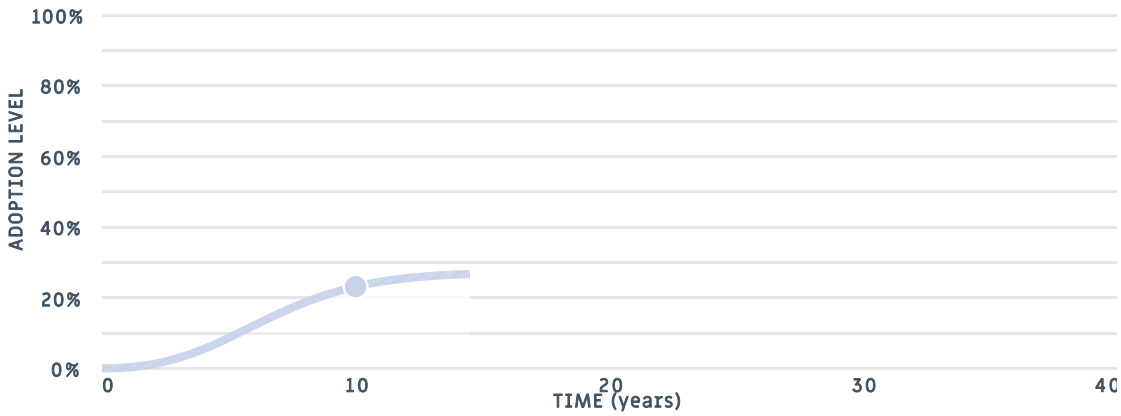
IN 10 YEARS FROM START

TIME TO 50% OF PEAK ADOPTION
(years)

NOTES: The predictions of Peak Adoption Level and Time to Peak Adoption Level are numeric outputs that are provided to assist with insight and understanding and like any forecasts should be used with caution. Time to Near Peak Adoption represents the time to 99% of the maximum predicted adoption level.

Adoption level S-Curve

The following chart shows how the level of adoption in the relevant population of farmers changes over time.



Yearly Adoption Levels

Year	Adoption %
1	0
2	1
3	3
4	5
5	9
6	12
7	16
8	19
9	21
10	23
11	25
12	26
13	26
14	27
15	27

(Peak Adoption)

Changing the adoption levels

Many of the factors can be changed by activities such as extension. Based on the data entered, the ADOPT model suggests that changing the following factors would have the biggest effect on adoption.

Changing the peak adoption level

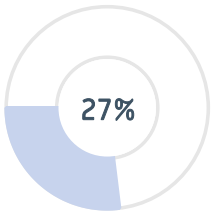
MOST SENSITIVE QUESTION

16 Profit benefit in years that it is used

To what extent is the use of the innovation likely to affect the profitability of the farm business in the years that it is used?

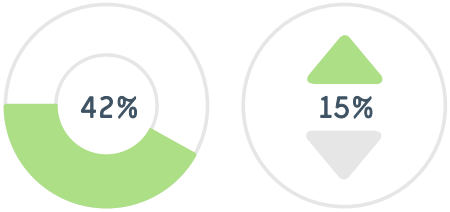
YOUR RESPONSE

Small profit advantage in years that it is used



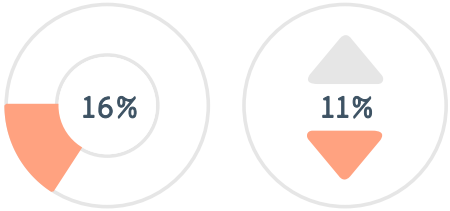
STEP UP RESPONSE

Moderate profit advantage in years that it is used



STEP DOWN RESPONSE

No profit advantage or disadvantage in years that it is used



Changing the time to peak adoption level

MOST SENSITIVE QUESTION

7 Trialable

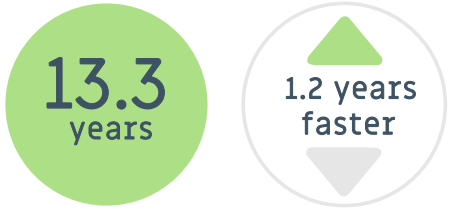
How easily can the innovation (or significant components of it) be trialled on a limited basis before a decision is made to adopt it on a larger scale?

YOUR RESPONSE

Difficult to trial

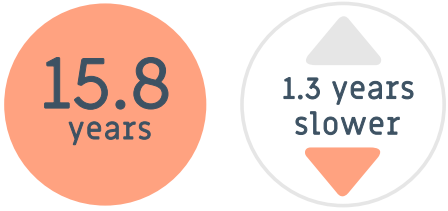
STEP UP RESPONSE

Moderately trialable



STEP DOWN RESPONSE

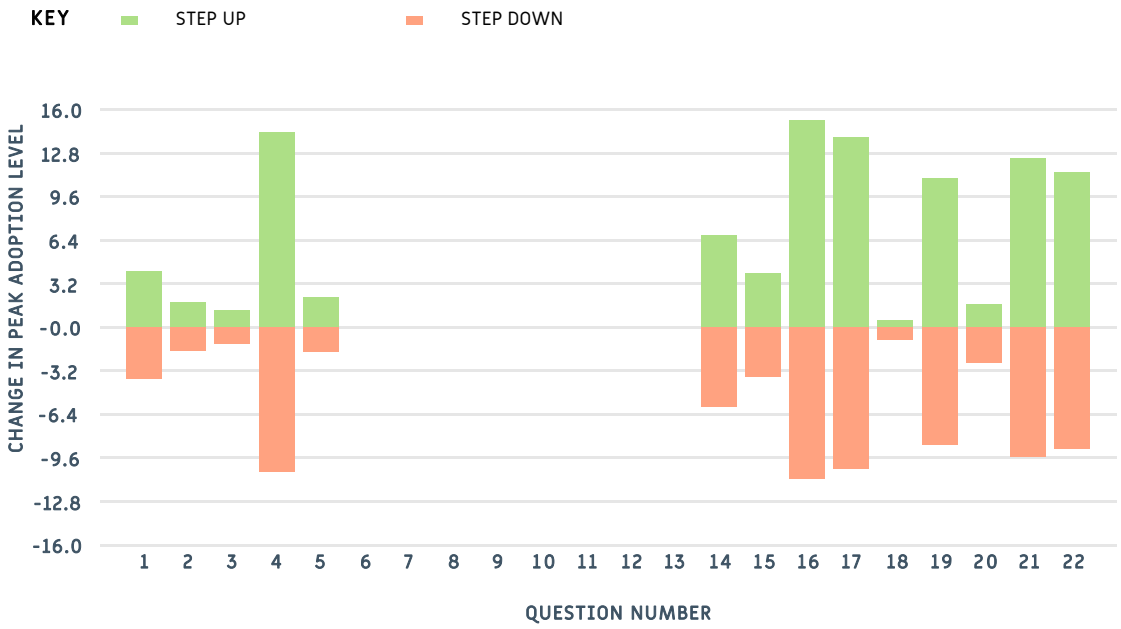
Not trialable at all



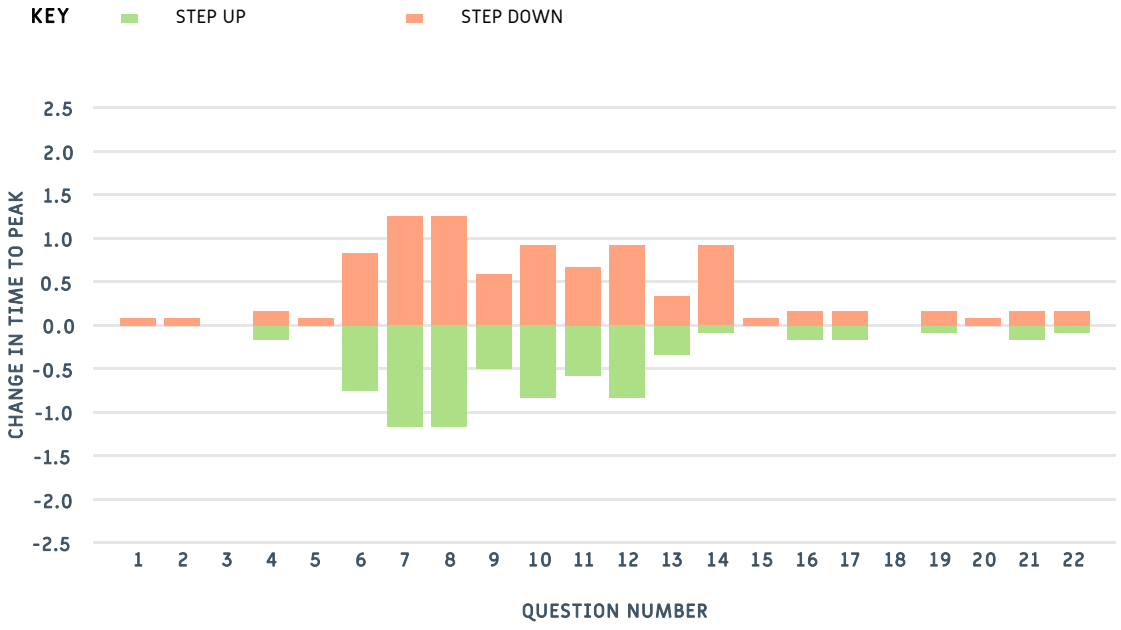
Sensitivity Analysis

The following charts show the effects on Peak Adoption Level and Time to Peak Adoption of single step changes up and down for all questions.

Peak level, sensitivity analysis

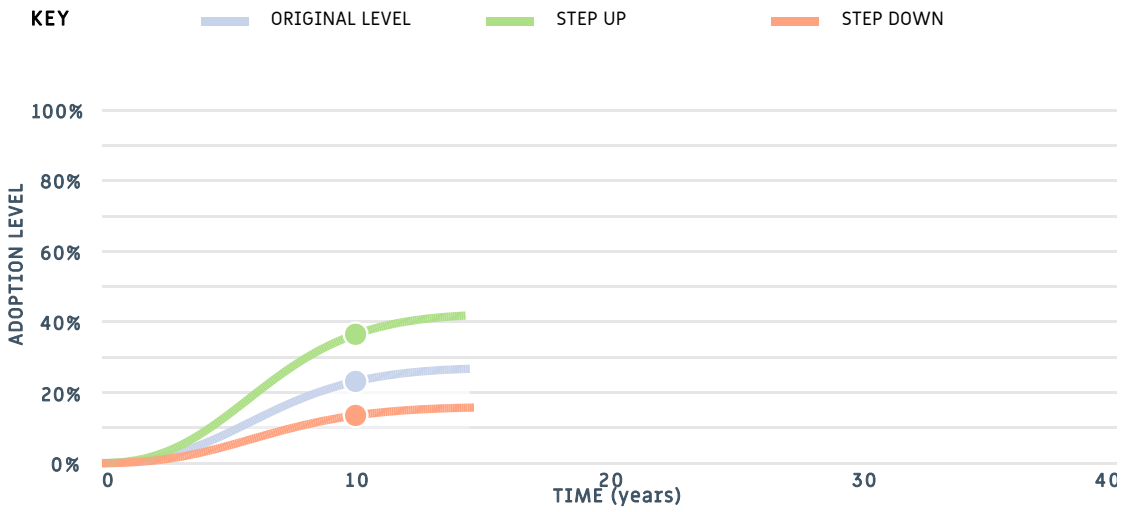


Time to peak, sensitivity analysis

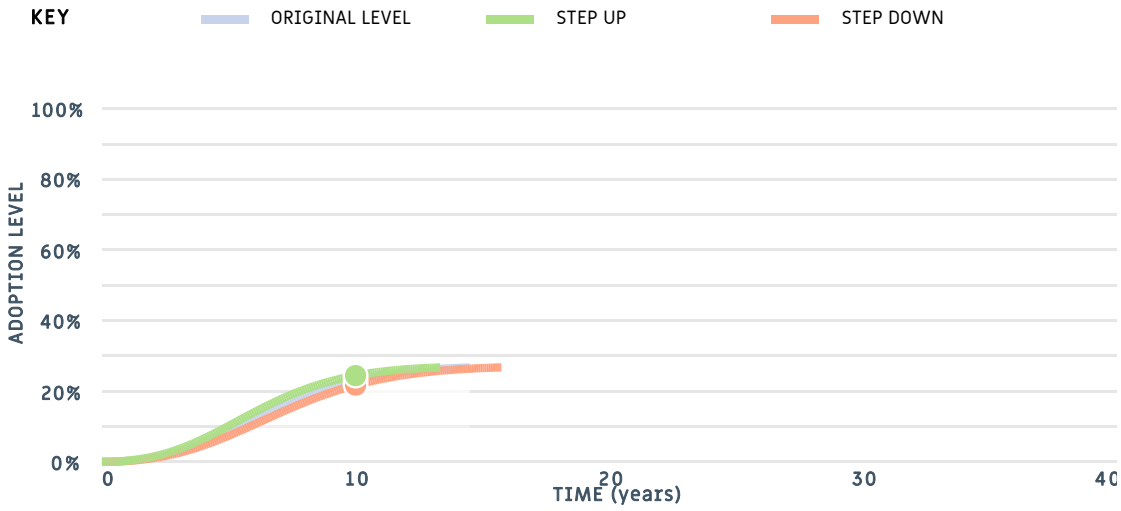


S-Curve Sensitivity

The following chart shows how the S-Curve is predicted to change when a single step change is made to the most sensitive question(s) with respect to Peak Adoption Level



The following chart shows how the S-Curve is predicted to change when a single step change is made to the most sensitive question(s) with respect to Time to Near Peak Adoption.



Responses

Question	Response	Reasoning
Relative Advantage for the Population		
1. Profit orientation	A majority have maximising profit as a strong motivation	We are dealing with commercial scale farmers and we assume a majority have maximising profit as a strong motivation.
2. Environmental orientation	About half have protection of the environment as a strong motivation	This is a typical assumption for large scale commercial farmers.
3. Risk orientation	A majority have risk minimisation as a strong motivation	For farmers in the unreliable low rainfall climate, risk reduction is assumed to be more commonly a strong motivation than for some other populations.
4. Enterprise scale	A minority of the target farms have a major enterprise that could benefit	The farms in the target low rainfall regions typically have grain as their major enterprise. About 65% have a livestock enterprise (mainly sheep) but only about half of those have livestock as a major enterprise relative to grain.
5. Management horizon	A majority have a long-term management horizon	This is assumed typical in this farming environment. Although there are some expectations of negative climate change effects in the low rainfall margins and continuing expansion of farm size through consolidation, a majority of farmers expect to be continuing to farm their land beyond 10 years under their family-based management.
6. Short term constraints	A minority currently have a severe short-term financial constraint	Only a minority of regions are currently under the constraints of severe but temporary multi-year drought.

Learnability Characteristics of the Innovation		
7. Trialable	Difficult to trial	The perennial species takes almost 2 years to reach a mature state to allow its success to be determined. It can be grown in a small trial area but this would require special management if its grazing value is to be determined in the trial. Being a perennial it is hoped that it will be highly resilient and survive over many years through extreme seasonal conditions. This resilience can not be easily trialed in a short-term.
8. Innovation complexity	Difficult to evaluate effects of use due to complexity	A perennial species has the potential to fill livestock feedgaps and influence the overall crop-livestock farming system e.g. potentially reduce supplementary feed requirements and possibly labour requirements relative to annual forage species. A perennial also has the potential to influence risk exposure. These factors are complex to evaluate compared to a simple innovation such as a new wheat variety that offers higher quality.
9. Observability	Easily observable	When grown the new species will be easily observable by nearby farmers. It does not look like currently grown species. it is expected that it will only be grown on a relatively small area of the farm so it is possible that it will not be located in a highly observable position on a farm for neighbours etc to always easily observe.

Learnability of Population		
10. Advisory support	About half use a relevant advisor	A majority of growers in the low rainfall region use a paid agronomy adviser but in some cases these will be tightly focused on cropping only advice.
11. Group involvement	A majority are involved with a group that discusses farming	A majority of farmers in these regions are engaged with organised farmer groups that involve farming discussions with farmer peers.
12. Relevant existing skills & knowledge	A majority will need new skills and knowledge	About half of the low rainfall farmers will have experience and skills growing some perennial pastures and some with trialing lucerne but this new variety will require additional knowledge and management considerations especially around grazing management and establishment.
13. Innovation awareness	A minority are aware that it has been used or trialed in their district	The number of local field trials has been limited by lack of seed availability during the pre-release phase so only a minority are ware of local trials in their district.
Relative Advantage of the Innovation		
14. Relative upfront cost of the project	Moderate initial investment	The seed is more expensive than average and land preparation requirements prior to establishment are substantial (eg requiring a year of strong weed control). No grazing is possible in the first year after seeding so this adds to the upfront investment required. If additional fencing is required for more manageable grazing paddock sizes for the perennial this would add to initial investment but has not been assumed in

		this case.
15. Reversibility of the innovation	Easily reversed	If it is decided to return to conventional plants it is easy to kill and resow a different option (eg it is not a woody plant). We have not assumed special fencing is required for the new perennial so this has not added to difficulties in reversing the adoption decision.
16. Profit benefit in years that it is used	Small profit advantage in years that it is used	Trials, simulation and experience where lucerne can be grown suggests that an area of successful perennial legume on approximately 10% of the typical farm area can increase whole farm profit by approximately 10% on average by supporting a higher farm stocking rate per pasture area without increasing average supplementary feeding requirements.
17. Future profit benefit	Small profit advantage in the future	The presence of a deep rooted perennial legume allows grazing of other annual pastures to be delayed in some seasons to allow for better establishment and less risk of over grazing of annual pastures that improves their overall productivity and seed production of self-regenerating annuals. This offers some potential benefits to pasture production and livestock enterprises in future periods but the extent is limited by the likely small proportion of perennial area.
18. Time until any future profit benefits are likely to be realised	1 - 2 years	Benefits to other pastures by the greater grazing management flexibility that having a successful perennial allows is likely

		to be realized later in the year or in the following season.
19. Environmental costs & benefits	Small environmental advantage	A successful deep rooted perennial legume may help to reduce N fertiliser requirements of that area of land compared to existing pastures and will increase water use that may be leading to possible salinity risk on some farms. A successful perennial may reduce some erosion risk in some years associated with annual pasture establishment in dry late seasons.
20. Time to environmental benefit	6 - 10 years	Greater water use and reduced salinity (seep) risk is considered to be the most substantial environmental benefit from the perennial relative to the other effects on N requirement etc. It is expected that this may take at least 6 years of perennial growth to be realised.
21. Risk exposure	Small reduction in risk	The deep rooted perennial will potentially reduce some feedgaps during dry periods. A more diversified farm business through a more profitable livestock enterprise will also reduce some farm business risk but carrying higher stocking rates can add to risk in very severe droughts. We assume only a net small reduction is farm business risk.
22. Ease and convenience	Small increase in ease and convenience	We have assumed only a small net improvement in ease and convenience. Managing a perennial legume (not unlike lucerne) requires more careful grazing management and

additional management considerations to standard annual pastures. However, having an area of perennial feed can offer an easier grazing option than supplementary feeding during some critical periods. For some farmers the long-lived perennial legume area will substitute for an annually sown perennial forage area and this will reduce inconvenience and time demand during critical crop seeding time.

ADOPT can be cited as: Kuehne G, Llewellyn R, Pannell D, Wilkinson R, Dolling P, Ouzman J, Ewing M (2017) Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy, Agricultural Systems 156:115-125 https://doi.org/10.1016/j.agsy.2017.06.007