GRASSING BARE PATCHES DEMONSTRATION

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Background

The grassing bare patches demonstration will be conducted as a citizen science project on three separate farms. The demonstration plots are to show different pasture revitalisation methods suitable for acidic and low fertility soils. The demonstration plots will assist landholders to identifying strategies that are practical, effective and easily applied on their small farms for establishing grassy groundcovers.

Identifying strategies and techniques that improve grassy groundcover will help landholders manage erosion, reduce sediment runoff and improve carbon sequestration through effective pasture establishment and maintenance. Improving grassy groundcover would also offer opportunities to improve productivity on small farms by providing more grazing capacity for stock and wildlife.

Aim

The overall aim of the demonstration is to test methods of improving ground cover through soil improvement in acidic and low fertility soils on landholder properties that exhibit problematic bare patches.

Duration and Timing

The demonstrations are to commence in September 2020 and conclude in May 2022. A final report on the strategies and outcomes based on the below agreed measures will be made available by the Small Farms Network Capital Region.

The network will hold a field day in May 2022 where other landholders may visit the demonstration sites (either in person and/or electronically depending on restrictions) where the physical results of the project can be viewed and discussed.

The timing of the various activities undertaken for the demonstration plots is listed below. (Appendix E)

Demonstration Plots

Each property participating in the grassing bare patches demonstrations will need to have between three to five demonstration plots of consistent size on their farm. The demonstration plots will need to be of similar topography, aspect and soil features at each farm. The size of each individual demonstration plot should be 5m x 5m, however smaller size demonstration plots could be used to a minimum of 2m X 2m.

Uniformity between demonstration plots can be determined initially with the use of a digstick to a depth of 20 cm. Observation of soil layers; colour, texture and pH are easily identifiable properties to ascertain uniformity. Once demonstration plot locations have been marked (wooden/plastic/metal pegs) samples can be taken for chemical analysis. Each demonstration plot should have a marker showing any treatment for that plot.

Soil samples from demonstration plots are combined to give a sample for each 5cm depth layer for each property. The depth layers are 0-5cm; 5-10cm; 10-15cm and 15-20cm (Appendix B). This provides a baseline from which acidity and fertility can be measured to show any change.

Treatments

Each farm will have two common demonstration plots; an untreated control and an improved system that will use a minimalist cultivation method to address the acidity and fertility of the soil. These two demonstration plots are mandatory for each farm. The common improved demonstration plot has the same activity undertaken across the three farms.

Key points of the common control demonstration plot

- No additional activity by the landholder
- Size for the control demonstration plot is 5m X 10m
- Grazing exclusion cage installed (Appendix D)
- No artificial irrigation

Key points of the common improved demonstration plot

- Appropriate quantity of lime is incorporated into the demonstration plot
- Light cultivation/raking to mix lime & seed into the surface 5 cm (Appendix B)
- Green manure crop in planted with the lime (Appendix C)
    - Ryecorn/crimson clover mix is broadcast sown at a rate of 40 grams per m^2
- Green manure crop seed is covered with jute mesh and pinned down
- Jute mesh covered with soil conditioner to 1 cm depth (Appendix C)
- Site should not be grazed (livestock or native) until green manure crop or final grass cover cannot be pulled from the ground.
- Temporary fencing maybe required.
- Grazing exclusion cage installed for each demonstration plot (Appendix D)
- No artificial irrigation

Final grass coverage

The green manure crop of 90% ryecorn and 10% crimson clover is to be "mulched" on a bi-monthly basis until the final grass cover is sown on the demonstration plot. The green manure crop should not be mulched two months prior to the sowing of the final grass cover. In March / April 2021 the farms chosen grass seed is sown on to the common improved demonstration plot, any variation plots and half of the control plot. After sowing the green manure crop is given the final mulching.

Optional Demonstration treatments

Each of the three farms may include optional treatments applied to additional demonstration plots with an aim to meet their long-term needs, complement farm activities/philosophy and to satisfy the enquiry of participants. The additional treatments should address the underlying aims of the demonstrations – to revegetate bare patches. It is highly recommended that only one factor is adjusted between any additional demonstration plots and the common plot. The network and the landholder will maintain a record of these treatment variations for the period of the demonstration (Appendix F)

For example
- No jute mesh
- Decrease the quantity of lime incorporated

- Increase the quantity of lime incorporated
- Change the soil conditioner / compost type or rate
  - Worm castings
  - Sheep/ chicken / turkey manure
  - Straw / hay
  - Mushroom compost
- Change the cultivation – increase the cultivation depth

Measures

Initial – September 2020

Pasture: Details of the existing pasture and paddock history should be recorded by the network and landholder. This includes
- Drone image to show demonstration plots
- Estimated bare patch size.
- Estimated percentage of bare patches within the paddock
- Fertiliser use
- Grazing history - estimated stocking rate
- Pasture composition (species sown/present)
- Pasture herbage mass

Soil: Baseline measures will be established across the demonstration plots, prior to any treatment and a non bare patch paddock plot on each farm in September 2020. Sampling should be done in 5 cm increments to a depth of 20 cm. (see Appendix A)

During demonstration period

Throughout the demonstration, observations of pasture performance should be recorded on a bi-monthly basis. It is highly recommended that photographs are taken bi-monthly
- Pasture composition (types of grass / weeds, frequency of difference species, percentage of ground cover)
- Weekly rainfall
- Green manure crop is slashed to increase soil carbon

Final sampling – September 2021

Pasture: As per initial measures
- Drone image to show demonstration plots
- Estimated bare patch size.
- Estimated percentage of bare patches within the paddock
- Fertiliser use
- Grazing history - estimated stocking rate
- Pasture composition (species sown/present)
- Pasture herbage mass

Soil: The final soil samples and other measures are to be taken from each individual demonstration plot to provide clear data about the individual changes and any benefits gained from the various strategies and methods. Core samples

are to be taken in the same manner as those initially taken but each demonstration plot is subject to its own analysis (Appendix A).

Other Participants

Other participants outside of the three farms are also invited to participate in the demonstrations at their own expense subject to attendance at a briefing. This will ensure consistency of approach.

Appendix A

Soil Samples

For both the initial and final soil measures, core soil samples are to be taken in each demonstration plot and analysed. The core samples are to be taken to a depth of 20cm with samples for each 5cm interval. For each of the three participating farms the soil tests to be analysed from the core samples are in the below table. Local Land Services will assist the three farms with conducting these initial soil tests.

Soil will be analysed for the following:
- Soil stability (slacking/dispersion tests, aggregate stability and turbidity)
- Colwell P
- Exchangeable cations, including aluminium (this gives CEC, Exchangeable sodium, Ca:Mg ratio, Al%).
- Soil pH
- soil organic carbon

Nutrient Advantage (IPL Werribee, Victoria) can do these tests using test code CT73 which provides soil pH (water and CaCl2), Electrical conductivity, Colwell P, Organic Carbon.

Initially the control, common treatment and any variation demonstration plot will be analysed in bulk, i.e. core samples for all the plots for each layer will be combined. However after treatment each variation plot including the common treatment plot will need to have separate soil tests as a final measure

Core samples are to be taken from each m^2 to a maximum of 5 core samples per demonstration plot. For a 5 x 5 m demonstration plot the core samples are to be taken in the following pattern.
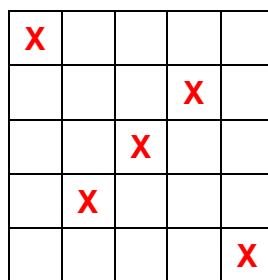

Figure 1 - soil core locations

To simplify the separation of the core layers and minimise contamination corrugated sheeting with 5 cm markings will assist. The landholder is highly recommended to take photographs of the core samples before separation into the different layers

Figure 2 - soil core samples at 2.5cm markings

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Initial soil tests

DEMONSTRATION PLOT	SOIL DEPTH	SOIL TEST
Control Plot , Common treatment plot and any variation plots - bulked sample		
	0cm - 5cm	Soil test 1
	5cm - 10cm	Soil test 2
	10cm - 15cm	Soil test 3
	15cm - 20cm	Soil test 4
Non bare Paddock (good plot)		
	0cm - 5cm	Soil test 5
	5cm - 10cm	Soil test 6
	10cm - 15cm	Soil test 7
	15cm - 20cm	Soil test 8

Final soil tests

DEMONSTRATION PLOT	SOIL DEPTH	SOIL TEST
Control Plot		
	0cm - 5cm	Soil test 1
	5cm - 10cm	Soil test 2
	10cm - 15cm	Soil test 3
	15cm - 20cm	Soil test 4
Common Treatment Plot		
	0cm - 5cm	Soil test 5
	5cm - 10cm	Soil test 6
	10cm - 15cm	Soil test 7
	15cm - 20cm	Soil test 8
Variation Plot 1		
	0cm - 5cm	Soil test 9
	5cm - 10cm	Soil test 10
	10cm - 15cm	Soil test 11
	15cm - 20cm	Soil test 12
Variation Plot 2		
	0cm - 5cm	Soil test 13
	5cm - 10cm	Soil test 14
	10cm - 15cm	Soil test 15
	15cm - 20cm	Soil test 16
Variation Plot 3		
	0cm - 5cm	Soil test 17
	5cm - 10cm	Soil test 18
	10cm - 15cm	Soil test 19
	15cm - 20cm	Soil test 20
Non bare Paddock (good plot)		
	0cm - 5cm	Soil test 21
	5cm - 10cm	Soil test 22
	10cm - 15cm	Soil test 23
	15cm - 20cm	Soil test 24

Appendix B

Soil Acidity

Soil acidity is caused by a number of factors including the age of the soil, the parent rock material, rainfall and organic matter levels. The most common strategy and method used to reduce the acidity of the soil (raise the pH) is by the use of agricultural lime. Lime can be incorporated into the soil or simply top-dressed and left to leach into the soil with subsequent rainfall; however lime moves slowly (0.5 to 1 cm per year) through the soil profile. Incorporation of the lime into the soil profile, where possible, will assist effective treatment. Normal incorporation of the lime is by mechanical means of ploughing. The liming rate will need to be adjusted for the minimal incorporation method used on the demonstration plots

The target soil pH_{Ca} for the common demonstration plot for the soil in 0 – 10cm soil profile is pH_{Ca} >5.5.

The appropriate amount of lime (as calculated below from the initial soil sampling) is to be incorporated into the common demonstration plot to a depth of at least 5cm. Based on the baseline soil test the amount of lime required for the common control plot for the three farms may vary. The below table provides the kilograms per 25m^2 with a 5cm deep incorporation. The rates have been halved as standard table provide the rates for a 10cm incorporation

Initial pH	Tonne / Ha	g/m^2	Kg/25m^2
4.2	1.625	163	4.1
4.3	1.5	150	3.8
4.4	1.25	125	3.1
4.5	1.125	113	2.8

Current accepted practice for surface liming is no more than 2.5 tonne per hectare per year. For this demonstration, the common demonstration plot of 25m^2 with surface lime incorporated to 5cm should not exceed 30kg.

Appendix C
Soil Fertility

Soil fertility can be improved by incorporating fertilisers. Three basic types of organic fertilizer are animal manure, green manure and compost. Cover crops (green manure) add organic matter to the soil, which leads to improved soil structure and, promotes a healthy and fertile soil. The soil fertility in the common demonstration plot will be addressed through the use of a soil conditioner and a green manure crop.

A locally sourced soil conditioner from the Queanbeyan Palerang Regional Council waste management program will be used. This a product produced from the local domestic green waste.

To ensure that the green manure crop of Ryecorn/Crimson clover remains in contact with the soil and loss to birds is minimised, the green manure crop will be directly sown on the limed soil, then covered with a jute mesh and then the soil conditioner. This should ensure adequate protection for the seed, good conditions for germination and an ongoing source of organic matter.

While jute mesh may not be a viable option for an entire paddock it is suitable for those troublesome bare patches in a paddock.

Ryecorn/Crimson clover sowing rate is 400kg per hectare which equates to 40 grams per m^2. The sowing rate for the demonstration plot will be 1.0kg per $25m^2$

The green manure crop is only short term to assist to increase the soil fertility which then allows the landholder to sow/ plant long term groundcover that is appropriate for their land use.

The green manure crop will be incorporated into the soil prior to the crop flowering. Green manures are generally incorporated by slashing / flattening or digging in while still lush and green. Leaving them to fully flower reduces the nitrogen content and increases the risk of weediness from seed set into the following crop. Digging in, whilst traditional, is not strictly necessary. This is a management decision as to what suits the aims of the landholder best. By slashing and leaving a green manure crop on the surface you create mulch for the following crop.

Appendix D
Grazing Exclusion Cage

After the initial withholding period to ensure that the green manure crop has germinated and is holding, grazing management is at the discretion of the landholder.

Grazing exclusion cages will need to be maintained on each of the demonstration plots including the control even where other parts of the plot are grazed. This will provide greater insight into the changes in the soil fertility and cover species in comparison to the control. The grazing exclusion cages will need not only to exclude the landholders grazing stock but also the native grazing animals (kangaroos, deer, ducks, rabbits etc.)

The grazing exclusion cages are to have no base and should be secured to the ground to avoid accidental disturbance. A suggested exclusion cage for each trail plot should be 500mm x 500mm square with a minimum height of 500mm. Ideally the cage should be made of 3 – 4mm metal mesh with an aperture of less than 50mm.
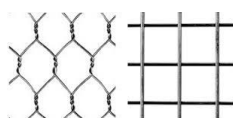

Figure 3 Grazing exclusion cage

Appendix E
Activity Timing

Date	Plots	Activity / Outcome
	Control	demonstration plots identified and marked
September 2020	Common improved, Variation 1,2,3	soil core samples taken from each plot at 5cm intervals initial measures soil analysis results lime rates determined & applied lime incorporated in top 5cm
September 2020	Control Common improved	Green manure crop sown (90% Ryecorn/ 10% crimson clover) Jute mesh cover Application of compost Total temporary grazing exclusion
	Control Common improved, Variation 1,2,3	Grazing exclusion cages
November 2020	Control Common improved, Variation 1,2,3	Pasture composition Green manure crop mulched
January 2021	Control Common improved, Variation 1,2,3	Pasture composition Green manure crop mulched
March - May 2021	Control Common improved, Variation 1,2,3	Pasture composition Pasture grass sown at a rate and type determined by each farm to meets their needs Green Manure Crop mulched by slashing/flattening
June 2021	Control Common improved, Variation 1,2,3	Pasture composition Grass cover management
July 2021	Control Common improved, Variation 1,2,3	Pasture composition Grass cover management
August 2021	Control Common improved, Variation 1,2,3	Pasture composition Grass cover management
September 2021	Control Common improved, Variation 1,2,3	Final measures taken soil core samples taken from each plot at 5cm intervals soil analysis results Pasture Herbage & composition
January 2022	Control Common improved, Variation 1,2,3	Pasture composition
March 2022	Control Common improved, Variation 1,2,3	Pasture composition
May 2022	Control Common improved, Variation 1,2,3	DEMONSTRATION FIELD DAY including pasture herbage & composition measures demonstrations

Appendix F
Demonstration Plot Variations
Farm 1- Jennie

Rates

Previous soil tests were for pH(CaCl) of 4.3 with sandy loam soil type.

Lime (Aglime250 Superfine) was applied at rate of 150g/m2 (equivalent to 1.5 tonne/ha).

Superphosphate (SuPerfect) was applied at rate of 12.5gm2 (equivalent to 125kg/ha)

Ryecorn Crimson Clover **green manure** was seeded at rate of 20g/m2.

QPRC soil conditioner **compost** was applied over surface in approximately 1cm deep layer.

Ripping was done with single tine behind small tractor to depth of approximately 150-200mm. Rip lines were located along contour and approximately 1.5m apart.

Control demonstration plot
- no action
- ½ with grass seed

Common improved plot
- Lime
- Green manure crop
- Jute mesh
- Compost
  - Grass seed
  - Green manure crop mulched

Variation 1 – minus jute mesh
- Lime
- Green manure crop
- Compost
  - Grass seed
  - Green manure crop mulched

Variation 2 – business as usual approach
- Lime
- Superphosphate
- Green manure crop
  - Grass seed
  - Green manure crop mulched

Variation 3 – ripping
- Ripping
- Lime (more placed in riplines)
- Green manure crop
  - Grass seed
  - Green manure crop mulched

Variation 4 – cool burning TBC
- Thin layer of grass/straw spread over surface
- Cool burn applied

no further intervention

Farm 2 Harji

Rates

Previous soil tests were for pH(Water) of 6.0 with sandy loam soil type which equates to pH(CaCl) 5.0. **Lime** (Ag Superfine) was applied at rate of 40g/m2 (equivalent to 400 kg/ha).

Ryecorn Crimson Clover **green manure** was seeded at rate of 20g/m2.

QPRC soil conditioner **compost** was applied over surface in approximately 1cm deep layer.

Scarifying was done with multitinr tine behind small tractor to depth of approximately 5-10 cm.

Control demonstration plot
- no action
- ½ with grass seed

Common improved plot
- Lime
- Green manure crop
- Jute mesh
- Compost
  - Grass seed
  - Green manure crop mulched

Variation 1 – minus jute mesh
- Green manure crop
- Compost
  - Grass seed
  - Green manure crop mulched

Variation 2 – mulching with grass clipping 15 sqm and Manure tea @2ltr with 8 ltr of water
- Green manure crop
  - Grass seed
  - Green manure crop mulched

Farm 3 - Allan

Control demonstration plot
- no action
- ½ with grass seed

Common improved plot
- Lime
- Green manure crop
- Jute mesh
- Compost
  - Grass seed
  - Green manure crop mulched

Variation 1
- Lime
- Green manure crop
- Compost
- No Jute mesh
- Incorporation by ripping to 10cm
  - Grass seed
  - Green manure crop mulched

Variation 2
- Lime
- Green manure crop
- Compos
- No jute mesh
  - Pelletised poultry manure
  - Grass seed
  - Green manure crop mulched