Building representative farming systems

Introduction to the questionnaire

The below questions are intended to help us understand the management of typical mixed crop-livestock farming systems in your region. The questions are grouped in seven categories dealing with separate, but interacting components of the farming system.

We've tried to find a balance between completely open versus structured questions in order to have room for each possible answer. However, a limited degree of structure was needed, to avoid we'd forget to ask about certain practices or management decision rules.

If you feel that the questions do not fit local practice, then tell us and try to describe the practices in another way.

1/ Land use and rotations

Characterize the different land management units of the farm according to:

- Area
- Years in the rotation cycle
- Soils
    - Soil type: specify the soil type. If appropriate, link to an APSIM soil or a principal profile form of the Australian system. If not, just give a descriptive name and specify the below characteristics. If the soil type typically varies within a paddock, consider whether an average soil type can be described, or whether the paddock needs to be split up. In the latter case, specify the area of each soil type within the paddock. If soil type variation within the paddock leads to different management, then different LMUs should be specified.
    - Texture
    - General level of (non-N) fertility
    - PAWC
    - Specify whether raised beds are used. If so, give dimensions of beds & furrows
- Rotations:
    - If fixed: for each LMU (land management unit), specify the crop/pasture/fallow for each season in the rotation cycle
    - If variable: for each LMU, specify the sequencing rules, and the crop/pasture/fallow for each season in the rotation cycle

What is the proportion of the farm area under each land use (crop/pasture/fallow) for each season? If these values change from year to year (e.g. in opportunity cropping system) specify the proportions in different types of years (wet, dry, average) and the average

2/ Crop Management

For each crop in each LMU, please specify the following:

- What is the most common variety used
- Specify the sowing rules
    - Does sowing occur on a fixed date or on a variable date, which depends on conditions
    - If fixed date, specify the date
    - If variable date, specify the start and end of the sowing window and whether sowing is mandatory at the end of the window or not
    - Specify the sowing requirements in terms of minimum rainfall, minimum days of rain and/or minimum available soil water as appropriate
    - Specify sowing depth and sowing density
    - Specify any sowing constraints if present
    - Specify the maximum area that is possible to sow in a day with representative machinery
- Specify the harvesting rules
    - Specify the minimum requirements that need to be met for a farmer to decide to grow a crop until grain setting. This could be in terms of minimum biomass at a certain date or minimum amount of rain in a certain period.
    - If the requirements are not met, specify whether the farmer would decide to sacrificially graze the crop, harvest it for conserved fodder (hay or silage), or leave it in the paddock. Describe the decision rules that govern the tactical choices between sacrificial grazing, fodder conservation and leaving the crop in the paddock.
    - In case of fodder conservation, specify the start and end date of the harvest window. (in case of grazing, specify grazing rules according to the question under grazing management).
    - If the requirements for grain harvesting are met, specify the start and end date of the harvest window and estimate the % of spilt grain
- Specify the fertilizer rules

  Several fertilizer rules are possible; pick the (combination of) rules that are most appropriate to describe the typical fertilizer management for the representative farming system
    - Is all (N) fertilizer applied at sowing, or split?
    - Would a soil N test be taken? If so, when? What exactly would be measured?
    - What form of N would be applied at or near sowing?
    - How is the timing of the sowing application of fertilizer decided?
    - Would the same amount always be applied at or shortly after sowing? If so, how much? If not, how would a farmer determine the N rate? (e.g. based on the previous crop, on the soil N test, target yield based on rainfall received so far)
    - [If split applications] How many subsequent fertilizer applications would be considered?
    - What form of N would be applied at subsequent applications?
    - How would a farmer decide the timing of the subsequent applications (fixed dates, time of year, crop stage, rainfall events, other)? What soil conditions would delay application?
    - How would a farmer decide the rate of each subsequent application? (e.g. based on the previous crop, on the soil N test, target yield based on rainfall received so far)
- Specify the in-crop weed management rules

Several weed management rules are possible; pick the (combination of) rules that are most appropriate to describe the typical weed management in your region. If the example rules don't reflect local best practice, tell us what it is.

  - Apply herbicide at a number of fixed dates: for each fixed date, specify the date and the type of herbicide
  - Apply herbicide at number of days before and/or after sowing: specify the number of days and the type of herbicide
  - Apply herbicide at a number of zadok growth stage windows: for each zadok window, specify the start and end growth stage number and the type of herbicide
  - Apply herbicide at a threshold of weed biomass: specify the minimum weed biomass (kg/ha) for spraying and the type of herbicide

- Production expectations

  Estimate the production in terms of grain yield and total biomass/or stover (kg/ha) for different types of years (expressed in percentiles: 10 – 30 – 50 – 70 – 90%) and specify whether this is at harvest or peak biomass (anthesis)

3/ Fallow/stubble management

Given the set of rotations/crop sequences, please list the possible short and long fallows.

Would all the short/long fallows be managed the same, or can they be grouped together?

For each class of fallow period:

- Residue management
  - Are residues ever burnt? If so, on which soil types; after which crops; and are tactical rules used to decide whether or not to burn and when?
  - Are residues ever removed (e.g. baling)? If so, on which soil types; after which crops; and are tactical rules used to decide whether or not to bale and when?
  - Are standing residues ever broken down mechanically? If so, on which soil types; after which crops; and are tactical rules used to decide whether or not to break them down and when?
  - Residue grazing is treated under grazing management
- Specify the fallow weed management rules
  Several weed management rules are possible; pick the (combination of) rules that are most appropriate to describe the typical fallow weed management in your region. If the example rules don't reflect local best practice, tell us what it is.
  - Apply herbicide at a number of fixed dates: for each fixed date, specify the date and the type of herbicide
  - Apply herbicide at number of days after harvesting: specify the number of days and the type of herbicide
  - Apply herbicide at a threshold of weed biomass: specify the minimum weed biomass (kg/ha) for spraying and the type of herbicide

4/ Pasture management

For each pasture type in each LMU, please specify the following:

- General information
    - Is it a permanent pasture, a sown ley or a volunteer ley?
    - Specify the main, secondary and tertiary species (if appropriate) and their estimated percentage of total dry matter production. Or if more appropriate (e.g. with shrubs) estimate the species percentage of total ground cover.
- Specify the sowing rules (if appropriate), except in permanent pastures
    - Does sowing occur on a fixed date or on a variable date, depending on conditions
    - If fixed date, specify the date
    - If variable date, specify the start and end of the sowing window and whether sowing is mandatory at the end of the window or not
    - Specify the sowing requirements in terms of minimum rainfall, minimum days of rain and/or minimum available soil water as appropriate
    - Specify sowing depth and sowing density
    - Specify any sowing constraints if present
- Specify the harvest for hay making rules (if appropriate)
    - Is forage ever conserved as hay or silage? If so:
    - At roughly what time of year is forage conservation carried out?
    - How would the farmer decide which paddocks to harvest in a given year?
    - Once the set of paddocks to be harvested has been decided, how would the timing of each cut be decided: fixed date or dates, threshold biomass, threshold digestible DM, maximum digestible DM, some other rule? If a biomass-based rule is used, is there a time window within which cutting takes place, and can second or third cuts be taken?
    - What is the expected DMD (dry matter digestibility) and protein content of the conserved forage (once in the shed or stack)?
- Specify the pasture ending rules (except in permanent pastures)
    - Specify the pasture killing method
    - If pasture ending is fixed, specify the date or the days before sowing a crop/another pasture
    - If pasture ending is variable, specify the decision rules; e.g. the minimum biomass on a certain date or the maximum biomass on a certain date for the farmer to decide to end the pasture phase
- Specify the fertilizer rules (if appropriate)
  Several fertilizer rules are possible; pick the (combination of) rules that are most appropriate to describe the typical fertilizer management for the representative farming system
    - Is all (N) fertilizer applied at sowing, or split?
    - Would a soil N test be taken? If so, when? What exactly would be measured?
    - What form of N would be applied at or near sowing?
    - How is the timing of the sowing application of fertilizer decided?
    - Would the same amount always be applied at or shortly after sowing? If so, how much? If not, how would a farmer determine the N rate? (e.g. based on the previous crop, on the soil N test, target yield based on rainfall received so far)
    - [If split applications] How many subsequent fertilizer applications would be considered?
    - What form of N would be applied at subsequent applications?

    - How would a farmer decide the timing of the subsequent applications (fixed dates, time of year, crop stage, rainfall events, other)? What soil conditions would delay application?
    - How would a farmer decide the rate of each subsequent application? (e.g. based on the previous crop, on the soil N test, target yield based on rainfall received so far)
- Production expectations (specify both or one of the following, as appropriate)
    - Estimate the production in terms of peak biomass (kg DM/ha) for different types of years (expressed in percentiles: 10 – 30 – 50 – 70 – 90%) and specify the timing of peak biomass
    - Estimate the production in terms of total biomass (kg DM/ha) at harvest for different types of years (expressed in percentiles: 10 – 30 – 50 – 70 – 90%)

5/ Animal management

- Specify the total stocking density (specify if in DSE/farm or DSE/pasture area)

For each livestock enterprise, specify the following

- The proportion of the total DSE on the farm
- The animal breed, including the ram/bull breed
- Specify the reproduction rules
    - Start and end date of joining
    - Are maiden ewes/cows joined separately, and if yes, when?
    - What kind of conditions would make a farmer decide not to mate at all?
    - Age at first joining
    - Conception rates:
        - Specify the % of animals having 0, 1, 2, 3 kids
        - Specify whether that % applies to mature animals or is an average value
        - Specify when the conception rate would be evaluated (scanning; marking; weaning)
    - Cows/ewes per bull/ram
    - Is scanning of ewes/cows practised? If so, when?
    - Are male offspring castrated or made into cryptorchids, and if so when?
    - Weaning rules: At what average age would lambs/calves usually be weaned? Would earlier or later weaning be practised tactically? If so, under what conditions? [prompt: maternal body condition, rainfall, pasture mass]
- Specify the replacement rules
    - Specify whether it is a self-replacing flock, or whether replacements are purchased. If replacements are purchased, specify the age and weight or condition score of the purchased animals and/or the rest of the herd/flock
    - Specify the age at which old animals are sold and the date
    - Are barren animals sold? If so, when?
- Specify the shearing rules
    - Specify the date for shearing of the main flock and the weaners
- Specify the rules for selling young stock

- How are young stock (those not needed as replacements) sold? (Free text answer, e.g. target sale weight, tactical responses to weather conditions, identifying multiple subsets of stock for sale into different markets, ...)

- Production expectations
  - Wool production: estimate the clean fleece weight per head of different stock classes (ewes, weaners, wethers). Indicate different production estimates for different types of years if appropriate.
  - Meat production in case of target weight selling of young stock: estimate the median date of sale; or indicate expected date of sale for different types of years
  - Meat production in case young stock are not sold to a target weight: estimate the average live weight of males and females (or each batch) at sale and indicate sale date; estimate live weights for different types of years if appropriate (indicate live weight or dressed (carcass) weight)

6/ Feeding management

- We require that animals be fed for maintenance if they fall below a nominated body condition.
  - What threshold body conditions should be used for different groups of stock and at different times of the year?
  - Should maintenance feeding aim to maintain body condition, or a nominated rate of weight change?
  - What kind of supplementary feed would be used? If a hay or silage, what DMD and protein content?
  - Where would the animals be fed
- Are any animals ever fed to achieve a production outcome?
  - If so, please describe the production outcome (prompts: seasons, animal classes, target weight, target date)
  - If so, please describe how this is done.
    - Prompts: earliest & latest dates, location of feeding, how the quantity to be fed each day is decided
    - What kind of supplementary feed would be used? If a hay or silage, what DMD and protein content?
  - Where would the animals be fed
- Are animals ever removed from the paddocks and fed in a feedlot to preserve ground cover (confinement feeding)? If so:
  - What rule is used to decide that confinement of livestock should start? [prompts: biomass, cover]
  - What rule is used to decide that animals should return to the paddocks?
  - What kind of supplementary feed would be used? If a hay or silage, what DMD and protein content?
  - Are different groups of animals fed different amounts? How are the daily amounts decided?

6/ Grazing management

Under grazing management, 4 broad types of grazing are covered, including pasture grazing, stubble grazing, grazing dual purpose cereals and sacrificial grazing of crops.

Given the set of land uses, specify the kinds of pasture and stubble that make up your main feed base

- Pasture grazing
    - Are all the pasture types made available for livestock to graze all year round, or are there times of year when particular pastures are closed to grazing? Why? [prompt: which pastures, when, based on which criteria]
    - How would you divide the livestock on the property up into classes for grazing management purposes? The set of classes can change over the course of the year... [Prompt: age classes, empty vs pregnant, single- vs twin-bearing]
    - Are there times of year when animals are set-stocked – that is to say, they are spread evenly across all the open paddocks?
    - At other times of year, how often would the farmer allocate stock to paddocks?
    - What rules would the farmer use to do this allocation? [Prompts: are some classes of stock assigned to better feed than others? If so, which classes and when?]
- Stubble grazing. For the stubbles of each crop type:
    - Are the stubbles ever grazed? If so:
    - Are they grazed immediately following harvest, to exploit remaining leaf and spilt grain?
    - If so, are animals brought in regardless of the availability of other forages, or are the stubbles treated as just another paddock?
    - If the former, which classes of stock are used to graze stubbles?
    - Is a particular stocking density (DSE/ha) used, or are all animals in a stock class or classes assigned to the stubbles?
    - How does the farmer allocate animals between multiple stubble paddocks during the post-harvest period?
    - At what point does the farmer end post-harvest grazing of each stubble paddock? [prompts: time, mass, cover, animal performance]
    - Once the post-harvest grazing is over, are stubbles ever grazed? If so, how do the stubble paddocks fit into the grazing rules described above?
- Grazing dual purpose crops
    - Specify the land management units and land uses where this practice might be conducted
    - Specify the start and end conditions for the grazing period in terms of minimum biomass, maximum zadok stage or maximum cumulative grazing days (for the end).
    - Specify the animal groups that are put on the crops
    - Is a particular stocking density (DSE/ha) used, or are all animals in a stock class or classes assigned to the dual-purpose crops?
- Sacrificial grazing of crops
    - Specify the land management units and land uses where this practice might be conducted
    - For decision rules for this practice, refer to “crop management”
    - Specify the start and the end of the period when crops might be grazed

    - Specify the animal groups that are put on the crops
    - Is a particular stocking density (DSE/ha) used, or are all animals in a stock class or classes assigned to the stubbles?

7/ Land and water management

For each land management unit and land use, specify the following land and water management information

- Cultivation
    - If tillage is done, specify the date and the type of machinery
    - Any other information we need to capture here?
- Irrigation management
    - Specify the type of irrigation
    - For each distinctive irrigation application, specify the amount of water and the timing in terms of the date, the zadok stage, the days after sowing, or the available soil water content below which to start irrigation
- Any other land and water management issue we'd need to capture?