**Table 17.2.** Farmer management options involving the use of organic inputs.

| Management option | Hypothesis | Drawback/constraint |
|---|---|---|
| *Quality* | | |
| Choice of species, especially if a cover crop/green manure | S1, S2, S4, S5 | Direct economic value usually dominates choice of species; potential conflict where there is more than one use. |
| Management of plants grown as green manure (low N gives less and slowly decomposing litter) | S1, S2, S4 | |
| Mixing organic sources in combination with mulch/manure transfer) | | Labour requirements |
| *Location* | | |
| Placement, e.g. surface-applied versus incorporated, flat versus ridged, band placement | S1, S9 | Erosion risks of tillage; volatilization losses from surface mulch |
| *In situ* mulch production – intercropping or sequential systems | | Competition in simultaneous systems |
| Mulch/manure transfer | | High labour requirements |
| *Timing* | | |
| Adjusting crop species to existing mineralization pattern | S7, S8 | Reduced choice of crop species |
| Timing of organic and inorganic inputs | S1 | Labour requirements; crop growth cycle; knowledge and lack of predictability |

- What if a technology required a farmer to collect cereal straw from his field, take it somewhere where it could be chopped finely, then mixed with a fertilizer, then carry it back to the field, and that this had to be done at a time when there were other important farm operations to be done, and he had no other labour available?
- What if a technology required the preparation of a compost, but that it was critical for the farmer to maintain the composting process at a particular temperature and within a narrow pH range?
- What if a particular quality of litter was found to promote synchrony due to its content of polyphenols, but the farmer also wanted to use the litter for feeding to farm animals, and it proved to have very poor digestibility?
- What if the measure that promoted synchrony required 3 years of no-response before the benefits became apparent, and the farmers were cash-poor farmers very dependent in the next crop for survival?

These scenarios are not presented in order to be negative, but rather to make it clear that researchers' enthusiasm for synchrony may not necessarily be shared by farmers, and that unless researchers recognize the need to consider farmers' constraints, the synchrony technology will go the way of many other so-called improved technologies.

Table 17.2 lists some farmer management options that involve the use of organic inputs. This shows that there are almost always drawbacks or constraints to the use of these inputs and that the individual options do not specifically address individual hypotheses. That is, a successful experiment or on-farm demonstration of such management options may not necessarily result in adoption, even though the results may well be consistent with one or more of the hypotheses.

## Conclusions

Research relevant to the synchrony concept far outnumbers research specifically testing synchrony hypotheses. Much of the research being done therefore neither proves or disproves that the synchrony hypotheses are valid. There is a need for strategic research to examine the various synchrony hypotheses. The role of the plant in contributing to synchrony is reaffirmed, particularly in respect of the plant's internal buffer and the root system reducing the need for exact synchrony. With nitrogen there is a need for further research into the potential to achieve synchrony through litter quality factors such as lignin and polyphenols. There is also scope for improving synchrony with respect to phosphorus through the use of organic inputs which reduce the rate of P fixation. Finally there is a need to identify practices that incorporate appropriate components of synchrony that would likely be acceptable to farmers. Such practices need to be taken to farmers through either or both adaptive and on-farm research.

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