ROLE OF MANAGEMENT IN RICE FARMING: RECENT EVIDENCE FROM THE MOUNTAIN FARMS OF UTTARAKHAND, INDIA

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INTRODUCTION

Conventional attempts to improve rice production have relied largely on the Genotype (G) x Environment (E) interactions emphasizing the application of standardized doses of commodified external inputs for providing a conducive environment to improved varieties. This strategy has however not been very effective in resource poor conditions in rainfed or hilly regions and has also ignored the important role of management (M) practices in rice farming. This study looks at some recent innovations in rice farming in the state of Uttarakhand to look at how the introduction of new management practices have impacted & improved rice cultivation in the mountains.

Crop Performance = G x E x M

G - Genotype/Variety
E - Environment (Soil, Water, Light, Temperature.....)
M - Management (of seedlings, water, weed, soil and nutrients)

OBJECTIVES

The study critically examines the effects of introduction of the System of Rice Intensification (SRI) on rice farming.

1)To unpack the role of the additional factor of management (M) of various elements in rice farming by relooking at the G x E x M interactions.

2) To explore how farmers have adapted elements of SRI principles by creating newer combinations of resource management on rice farms

METHODOLGY

A research study was undertaken to explore and understand the changes in resource management mechanisms under the influence of SRI. Four villages of Bhilangana block of Tehri Garhwal district of Uttarakhand, where SRI was introduced in 2008 were purposively selected accommodating socio-economic and bio-physical diversity. Focus group discussions were held to understand the diversity of the mountain rice farming systems. All the irrigated rice plots of 258 farmers pursuing different rice cultivation methods in these villages were followed throughout the entire rice season of 2011 to capture the variations and inter linkages in management practices amongst farmers and fields, and resulting yields. The field studies in combination with participant observations, focus group discussions and structured interviews with key informants yielded in-depth knowledge of modifications and mechanisms influencing farmers' choice, resource management practices and their effectiveness.

RESULTS

The predominant conventional rice cultivation methods in the selected mountain villages include (a) broadcasting un-sprouted seeds in un-irrigated fields (*Sathi*), (b) direct seeding of sprouted seeds in puddled fields (*Saindha*) and (c) transplanting seedlings in fields irrigated later through rainfed sources (*Bina/Bijwad*) or while thinning in *Saindha*.

Common Practices in Conventional Mountain Rice Cultivation Methods

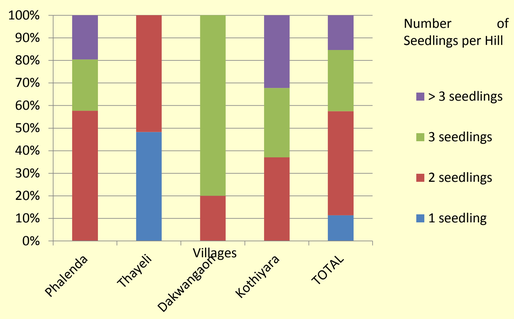
Method	Unirrigated *Sathi* (Broadcasting)	Irrigated *Bina* (Transplanting)	Irrigated *Saindha* (Direct Seeded)	Irrigated Transplanting from *Saindha*
Seedling Age at Transplanting	-	40 - 75 days' old	-	25 – 75 days' old
Seedlings/Hill	-	6 - 10	-	3 - 6
Plant to Plant Spacing (cms)	Random	Random 10 – 22.5 cms	-	Random 10 – 22.5 cms
Water Management	Rainfed	Flooded Condition	Flooded Condition	Flooded Condition
Weed Management (Number of weeding)	2 (by Hoe) + 1 (by Hand) at convenience	1 (in Nursery by Hand/Hoe) + 1 (by Hand) at 20-30 days interval	4 (by Hand) at 15-25 days interval	2 (in Saindha by Hand) + 1(by Hand at 15-25 days after transplanting)
Nutrient Management	0-4 T/ha before sowing	0-3 T/ha before transplanting	0-3.5 T/ha before seeding	0-3 T/ha before transplanting

Apart from the above, about 50 per cent of the resident farmers (127) were also found to be applying different elements of SRI with wide variability in 10 per cent of the irrigated rice fields. The modifications made by farmers against the recommended SRI management practices in the fields are presented below.

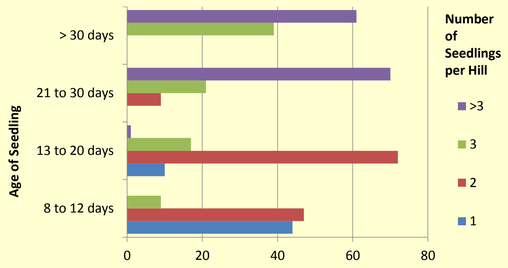
(I) Seedling Age

8-12 days' old seedlings were used only in 15 per cent of the rice fields whereas in 56 per cent of rice fields 13-20 days old seedlings were transplanted. Preoccupancy in un-irrigated fields, and unavailability of water and bullocks for draft power along with cultural constraints caused delay in transplanting. Farmers also preferred using aged seedlings as young seedlings are difficult to handle, and are more prone to insect damage and water rot.

(II) Number of Seedlings/Hill



One seedling/hill was transplanted only in 11 per cent of the rice fields where the seedling age was less than 15 days. Farmers preferred to transplant 2 seedlings/hill as risk coping strategy against mortality of younger seedlings. Thus, in 46 per cent of the rice fields 2 seedlings/hill were transplanted. The number of seedlings was found to be increased according to the seedling age.



Percent of Rice Fields under different categories of age of seedlings

(III) Seedling Spacing

In about 80 per cent of the rice fields line transplanting was followed (through one sided marking) whereas only 5 per had grid transplanting (through cross marking). Apart from the above in 15 per cent of the rice fields farmers transplanted in lines without the use of markers through eye estimation .

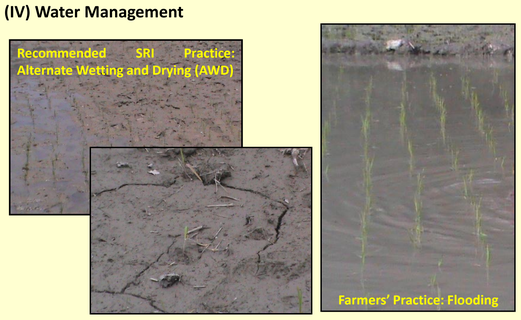
(a) Farmers avoid grid transplanting as

- Cross marking requires more effort
- Transplanting within grid is difficult, especially for elderly women

(b) Farmers avoid use of markers as

- Marking requires optimum soil and moisture conditions
- Difficult to operate in improperly levelled, irregular and small terraces
- Draining and drying fields for marking delays transplanting

(IV) Water Management



In none of the rice fields farmers made extra efforts towards ensuring alternate wetting and drying. Farmers adhere to flooded irrigation as

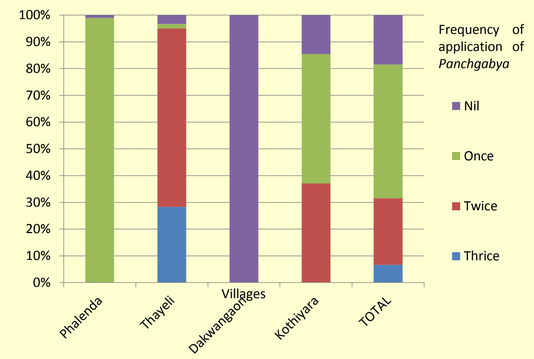
- Drainage is difficult due to heavy rains
- Scattered landholdings and field to field irrigation restricts AWD
- AWD requires close monitoring
- Flooding controls insect damage
- Flooding curbs weed growth while preoccupation in other activities

(V) Weed Management

In about 79 per cent of the rice fields 1-2 weeding were undertaken whereas only 5 per cent were weeded thrice through the use of Mandva weeder. Apart from the above in 16 per cent of the rice fields (mostly where transplanting was done through eye estimation without the use of marker) undertook only hand weeding as per convenience. Weeder use is usually delayed and also supplemented by hand weeding.

Timely weeding operations are affected by preoccupation in other agricultural operations, especially in unirrigated fields and water unavailability. The weeder operation is difficult in small, irregular terraces and in sandy soils. Farmers also reported delayed weeding leads to cutting of tillers.

(VI) Nutrient Management



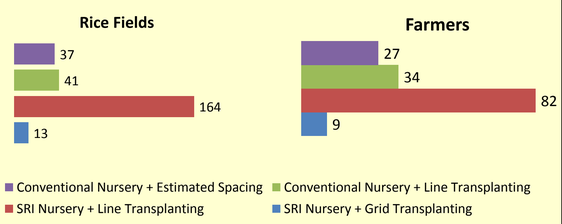
Out of the three types of liquid manures recommended (*Panchgabya*, *Amrit Ghol* and *Matka Khad*, farmers were found to be applying only Panchgabya). *Panchgabya* is a liquid organic manure prepared from a mixture of five cattle products, i.e., milk, yoghurt, clarified butter, urine and dung. In only 7 per cent of the rice fields *Panchgabya* was applied thrice whereas in 75 per cent of the fields it was applied once or twice at 10-20 days interval.

In 18 per cent of the rice fields, farmers did not apply Panchgabya at all. The reported constraints in the use of the liquid manure are:

- Preparation of *Panchgabya* is time taking
- It requires costly ingredients
- *Panchgabya* has foul smell
- *Panchgabya* flows away to other fields

Thus the timely application of *Panchgabya* is subjectedto its preparation by Master Trainers and/or Village Level Resource Persons appointed by the local SRI promoting agency.

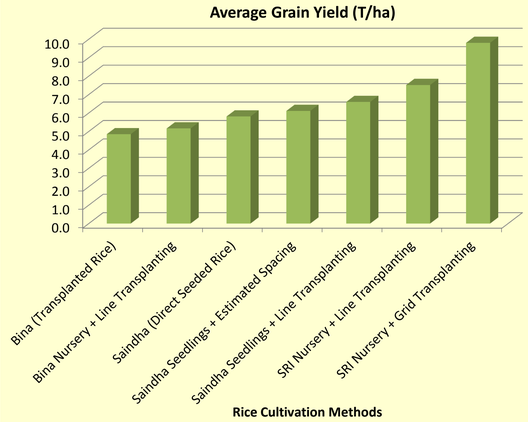
(VII) Major Emerging Rice Cultivation Practices

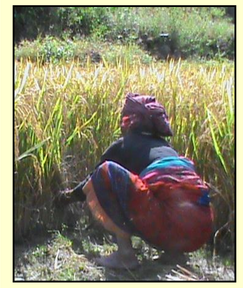


Thus the most prominent emerging form of rice cultivation practice due to introduction of SRI in the mountain farms is the use of younger seedlings from the raised bed nurseries followed by line transplanting as observed in 64 per cent of the rice fields.

(VIII) Yields

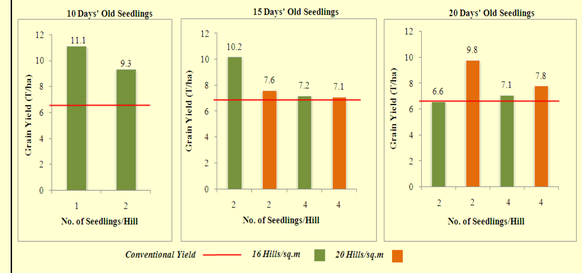
The grain yields obtained through different rice cultivation methods based on measurements from 205 rice plots clearly reflect the advantage of management practices under SRI as compared to the conventional methods.





The modified management practices enabled the farmers to get an incremental grain yield ranging from 5 per cent to 70 per cent. The impact of some of the seedling management practices can be visualized from different treatments carried out on a farmer's plot under similar water, weed and nutrient management. The best grain yields were obtained with the use of 10 days' old single seedling at 25 cms x 25 cms row to row and plant to plant spacing.

Impact of Seedling Management Practices on Grain Yields (Variety: *Barik Anaj*)



These treatments carried with 10, 15 and 20 days old seedlings showed that it is better to reduce the spacing between seedlings than increasing the number of seedlings/hill to compensate for the loss in grain yields due to increase in the age of seedling .

CONCLUSIONS: RETHINKING THE ROLE OF MANAGEMENT IN AGRONOMY

The study of mountain farmers' practices of SRI shows that they follow varying rice cultivation methods across different rice plots based on their needs, resources, knowledge, experience and management skills.

The study highlights the need to include and understand the G X E X M interactions in the local context while building up and extending new package of practices to enhance rice productivities for meeting increasing food demands. G x E x M interactions seems to offer the farmers the scope to enhance resource management use efficiencies of agro-inputs possibly through synergetic effects.

Though the new system demands more in terms of skills and synchronized efforts than customary, it has received wider acceptability since it offers a tool kit with a diverse mix of management practices from which farmers can select, apply, learn and modify according to available resources and their preferences.

The requirement of new skills, unavailability of resources on time, unfavourable land characteristics as well as clash with established agricultural routines and cultural practices results in deviations from recommended SRI practices as well as adaptations in the conventional rice farming practices.

Various bio-physical and socio-economic determinants shape SRI as well as the conventional management practices. The prominent adaptations in rice cultivation methods due to introduction of SRI are use of comparatively

- Younger seedlings (16-25 days' old seedlings)
- Fewer seedlings per hill (2-3 seedlings/hill)
- Wider spacing (row to row spacing of 20-25 cms with reduced plant spacing).

Farmers while rejecting the concept of alternate wetting and drying (AWD) have preferred undertaking 1-2 mechanical weeding (or even hand weeding in absence of marking) and the application of organic manure (is optional).

Future research should be undertaken to determine the various combination of rice management practices which will give best results under varying conditions of resources.