National Bank for Agriculture and Rural Development

Jharkhand Regional Office
Ranchi – 834 001, Jharkhand, India

0651-2361107
0651-2361108

Report on System of Rice Intensification (SRI)

2010-2011

The report summarises the results of the 1st year programme of the pilot project on SRI launched by NABARD during 2010 'Kharif' season. The project is targeted to cover 30,000 farmers covering 7,500 acres in 22 districts of the state of Jharkhand through 49 Project Implementing Agencies and 5 Resource Agencies, spread over 2 years. The results indicate substantial increase in paddy yield and consequent food security for the small land holders in Jharkhand covering upland, midland and lowland situations
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BACK GROUND

Agriculture Profile of Jharkhand

Jharkhand State covers an area of 79,714 sq. km with the total population of 26.9 million. The State extends between the latitudes 22 degrees North to 25.5 degrees North latitudes and the longitudes 83 degree East and 87.75 East. Although Jharkhand State is endowed with vast and rich natural resources, mainly those of minerals and forest. The 80% of its population who reside in 32,620 villages depend mainly on agriculture and allied activities for their livelihoods.

The productivity of crops in Jharkhand is low, and the deficits between demand and supply are as high as 52% in the case of cereals, 65% in the case of fruits, 51% in the case of milk and 34% in the case of fish. Only one crop is taken during the *kharif* season in most parts of the State, and current fallow and other fallow lands amount to 2.0 million ha (about 25% of the area). It is thus clear that accelerated agriculture development holds the key to food security as well as to poverty eradication and employment generation in the State. The terrain is highly undulating. In the valleys, mainly paddy is being cultivated, while in upland areas, maize, jowar, ragi, vegetables and other crops are being cultivated. The total forest area in the State is 23.32 lakh ha, covering 29% of the State's total area (79.71 lakh ha.). This is considerably above national average of about 18%.

The annual average rainfall is about 1,386 mm, occurring mainly during the four months of the monsoon period (June to September). Most of the agricultural area, about 92%, is under rainfed cultivation. Although the monsoon rainfall is regular, its temporal and spatial distributions are irregular. The frequent dry spells and low rainfall during critical crop growth periods lead to drought, with the excess rainfall over specific period leads to flooding. In addition, untimely hail storms also affect crop production in the State almost every year.

Table. 1 Agriculture profile of Jharkhand

Population	21,843,911
Scheduled tribes	28% of total
Scheduled castes	12% of total
Per capita income	Rs. 4161
Density of population	274 persons/km^2
No. of districts	22
No. of subdivisions	33
No. of blocks	211
No. of villages	32,620
Total geographical area	79.70 lakh hectares
Cultivable land	38.00 lakh hectares
Net sown area	18.04 lakh hectares (25% of total area)
Net irrigated area	1.57 lakh hectares (8% of net sown area)
Forest	23.00 lakh hectares (29% of total area)

Agro Climatic Conditions

The climate of the region is influenced by its geographic location and physical features. Located at elevations between 300 and 610 meters above sea level, the climate ranges from dry semi-humid to humid semi-arid types. The State comes under Agro-Climatic Zone VII, i.e., Eastern Plateau and Hill Region. The region is further subdivided into three zones, namely: Central Northeastern Plateau Zone; Western Plateau Zone; and Southeastern Plateau Zone. In general, the plateau region of Chotanagpur and Santhal Parganas is characterized by humid and sub-humid tropical monsoon in subzone IV, sub-humid to subtropical in subzone V, and humid to sub-tropical in subzone VI. Important characteristics of the three subzones are:

Table 2. Agroclimatic subzones and their characteristic		
Subzones	**Districts**	**Characteristics**
Central Northeast Plateau (Zone IV)	Deoghar, Dumka, Sahibganj, Pakur, Jamtara, Godda, Hazaribag, Ramgarh, Giridih, Koderma, Dhanbad, Bokaro	1. Low water-retention capacity of the soil, particularly that of uplands 2. Late arrival and early cessation of monsoon, and erratic and uneven distribution of rainfall 3. Lack of safe disposal of runoff water during monsoon and of water storage and moisture conservation practices for raising rabi crops. 4. Drying of tanks and wells by February results in no rabi crop production.
Western Plateau (Zone V)	Ranchi, Khunti, Gumla, Simdega, Lohardaga, Palamu, Latehar, Garhwa	1. Late arrival and early cessation of monsoon 2. Erratic /uneven distribution of rainfall 3. Low water-retention capacity of soils 4. Lack of soil and water conservation practices
Southeastern Plateau (Zone VI)	W. Singbhum, E. Singhbhum, Seraikela-Kharsawan	1. Uneven distribution of rainfall 2. Low water-holding capacity 3. Eroded soils 4. Poor soil

Water Resources

The annual rainfall in the plateau and sub-plateau region is 1,400 mm on an average, of which 82% is received during the period June to September, and the rest 18% in the remaining months. The distribution patterns of rainfall in the different subzones are as below.

Table 3. The distribution pattern of rainfall in different subzones

Subzones	Annual rainfall (mm)	Kharif (June to October)
Subzone IV	1,320	80%
Subzone V	1,246	70%
Subzone VI	1,400	81%

The state receives rainfall 1200-1600 mm/annum. Precipitation is rather variable. Winter season precipitation is meagre and highly variable. There are, on average, 130 rainy days in a year and on 75 days, rainfall is below 2.5 mm. On 55 rainy days, evaporation level is more than 2.5 mm per day. Out of the average annual precipitation of 10 million hectare-meters in the State, it is estimated that about 20% is lost to the atmosphere, 50% of flow as surface runoff, and the balance of 30% soaks into the ground as soil moisture and ground water. There are a number of perennial rivers and streams flowing through the State. The important rivers are Damodar, Subarnarekha, Koel Karo, Barakar, and Sankh. Source of irrigation in different agro-climatic zones of Jharkhand are shown below

Table 4 Source of irrigation in different agro-climatic zones of Jharkhand

ACR Subzone	Total Irrigated area (ha)	Irrigated area as % of total cropped area	Source of Irrigation (ha)			
			Canal	Tank	Tube well	Well & others
Zone IV	11,237	6.58	1,888	3,433	534	5,516
Zone V	21,956	9.65	3,732	801	3,228	14,381
Zone VI	15,510	4.58	10,211	2,156	409	2,733
Total	48,703		15,831	6,390	4,171	22,630
Share in Irrigation (%)			32.29	13	8.51	46.16

The area under irrigation have been variously reported as about 10.3% (2003-04, Ministry of Agri, GoI) and 10.73% (1997-98 Report of Commission on Agricultural Reforms, Research and Development March 2008). However, the crop-wise data on irrigated area under principal crops is not as encouraging. The area of land under food grains with irrigation was reported to be only 7.5% during 2003-04.

Land Utilisation Pattern

About 3.8 million hectares (m ha), or 48% of the State's geographical area, is cultivable. About 70% of the farms are smaller than 1 ha in size, and another 15% are 1 to 2 ha, with an average of about 1.2 ha. Only 2.5% of the farms in the State are larger than 10 ha. The overall cropping intensity is approximately **110%**.

Table 5 Zone-wise land utilization pattern

Classification of Land	Zone IV		Zone V		Zone VI	
	Area ('000 ha)	%	Area ('000 ha)	%	Area ('000 ha)	%
Geographical area	3,518.4	100	3,095.1	100	1356.6	100
Forest area	989.7	28.1	896.6	29.0	446.3	32.3
Land put to non-agricultural. use	290.6	8.3	178.5	5.8	187.5	13.8
Barren & unutilised land	268.3	7.6	191.6	6.2	113.3	8.4
Cutivable wasteland	132.3	3.8	103.2	3.3	76.1	5.6
Permanent pasture & other grazing land	78.1	2.2	7.7	0.3	7.2	0.5
Land under miscellaneous trees	50.1	1.4	37.2	1.2	18.7	1.4
Other than current fallows (2 to 5 yrs)	391.5	11.1	322.4	10.4	90.1	6.6
Current fallows	501.5	14.3	557.2	18.0	95.5	7.0
Net sown area	759.3	21.6	761.9	24.6	309.1	22.8
Total cropped area	852.6	24.2	881.2	28.5	337.9	24.9
Area sown more than once	93.3	2.7	119.4	3.9	28.8	2.1
Cropping Intensity	112.3		115.7		109.3	

Food Grain Production

The State produces barely half of its food grains requirement; the country, on the other hand, produces a surplus of 9%. In a recent study, Jharkhand was classified as a "extremely food insecure State," along with Bihar.

Table 6 Total area and irrigated land under different foodgrains

Sl. No.	Major Crops	Area under food grains (%)	Area under irrigation (%)
1	Rice	70	5.6
2	Wheat	3	86
3	Maize	9	1.8
4	Others (jawar, bajra)	2	NA
5	Pulses	15	2.2
	Total food grains	100	7.5

* Agricultural Statistics 2006-07, Ministry of Agriculture and Crops, Government of India

Analysis of available data shows that against a requirement of 40 lakh tonnes of food grains for a population of 26 million, current production is 22 lakh tonnes. The shortfall in food grain production is highest in subzone IV (Central Northeastern Plateau) followed by the Western and Southeastern Plateau zones.

Table 7. Subzone-wise productivity (present vs. desired levels)

Sub-zone	Present Level			Desired Level	
	Cropped area (M ha)	Food grain production (M tonnes)	Productivity (T/ha)	Food grain requirement (M tonnes)	REQUIRED PRODUCTIVITY (T/ HA)
IV	1.04	1.13	1.09	2.24	2.15
V	0.77	0.62	0.80	1.09	1.40
VI	0.39	0.35	0.90	0.64	1.64
Total	2.20	2.10	0.93	3.97	1.73

Table 8 Area and average productivity of important crops

Crop	Agro- Climatic Zone					
	IV		V		VI	
	Area (000 ha)	Productivity (q/ha1)	Area (000 ha)	Productivity (q/ha)	Area (000 ha)	Productivity (q ha-1)
Rice	836	11.28	328.5	6.9	330	4.5
Ragi	43.7	7.66	--	--	1.0	3.6
Maize	117	13.11	41.6	8.0	6.7	8.1
Wheat	92	16.00	14.0	6.5	1.9	6.6
Red gram	8.6	11.41	17.0	7.5	0.6	7.4
Niger	12.3	4.0	19.3	3.7	2.0	2.7

In the Jharkhand scenario, there appears to exist a significant potential for raising productivity in rainfed systems through reduction in yield gap, e.g., through adoption of better technology like SRI, and/or increasing cropping intensity through water harvesting and its subsequent utilization in growing a second crop, or through water saving methods such as possible with SRI.

A reduction in yield gap by 50%, could result in food grain to the extent of 5.4 lakh tons. Similarly, increase in cropping intensity by 25% in the short term, could result in an increase in production by 9.12 lakh tons. Both of these approaches together could result in additional food grain production to the amount of 14.52 lakh tons, i.e. a 40% increase over the present production, an achievable target in a span of three years.

Table 9. Crop-wise Area, Production and Yield Estimates of Major Crops with a 50% Reduction in the Present Yield Gap

Sl. No.	Crop	Area (lakh ha)	Production (lakh tonnes)	Yield (kg/ha)			All-India yield (kg/ha)	Additional production by reduction of yield gap by 50% (lakh tonnes)
				Existing	Potential	Gap		
1	Rice	16.04	29.37	1831	1971	140	1971	2.25
2	Maize	1.91	2.78	1460	1700	240	1911	0.46
3	Wheat	1.079	1.575	1541	2500	959	2696	1.03
4	Ragi	0.447	0.338	1000	2000	1000		0.45
5	Pulses	2.91	1.9	650	960	310	598	0.90
6	Oilseeds	0.94	0.53	560	892	332	896	0.31
	Total	23.326	36.493					5.40

Table 10. Crop-wise Area, Production and Yield Estimates of Major Crops with a 25% Increase of Cropping Intensity

Sl. No.	Crop	Area (lakh ha)	Production (lakh tons)	Yield (kg/ha)			All-India yield (kg/ha)	Additional production from increasing cropping intensity by 25% (lakh tons)
				Existing	Potential	Gap		
1	Rice	16.04	29.37	1831	1971	140	1971	7.34
2	Maize	1.91	2.78	1460	1700	240	1911	0.70
3	Wheat	1.079	1.575	1541	2500	959	2696	0.39
4	Ragi	0.447	0.338	1000	2000	1000		0.08
5	Pulses	2.91	1.9	650	960	310	598	0.48
6	Oilseeds	0.94	0.53	560	892	332	896	0.13
	Total	23.326	36.493					9.12

Economic Situation & Food Security

The total population of the State according to the 2001 Census is 2.69 crore, with an average density of population of 338 per sq. km, as compared with the all-India average of 324. Jharkhand ranks 13th in terms of population, accounting for 2.62 percent of the all-India population. The State's share of tribal population is about 28% of the total population.

Jharkhand has one of the highest levels of poverty in India at 40% as against the all-India average of 27.5%. There is sharp contrast between rural and urban poverty rates in the State, 49% vs. 23%; 70% of its population depend mainly on agriculture and allied activities for their livelihoods, contributing about 15% to Jharkhand's gross domestic product. This compares with almost the same proportion of agricultural workers in the country as a whole (58%) contributing contribute about 23 % of national GDP. This statistical comparison broadly reveals the low productivity of Jharkhand agriculture.

Situation Analysis

The last four decades of Indian agriculture registered overall impressive gains in food production, food security and rural poverty reduction in the better-endowed areas participating in the 'Green Revolution.' This, however, by-passed the less-favored rainfed areas, which were not partners in this process of agricultural transformation. Several other factors related to agriculture sector as a whole have also contributed to non-remunerative yields and heightened distress for the rural population, e.g., adverse meteorological conditions resulting in long dry spells and droughts, unseasonal and sometimes excessive rains, and extended moisture-stress periods with no mechanisms of storing and conserving surplus rain to tide over the scarcity/deficit periods.

It is only recently that the Government of India has constituted a National Rainfed Area Authority (2006) to address these issues and develop and implement a comprehensive single-window program for the development of rainfed areas in the country. The success of the 'Green Revolution' in irrigated areas is an example of development built upon irrigation expansion and improved technologies. A second 'Green Revolution' along the same lines is not in the offing for long time because it needs to be staged in water-scarce/insufficient zones.

Promising Technologies and Replicable Interventions

Protective Irrigation

The most critical issue facing much of the tribal region of the State is food insecurity arising from the unstable monsoon affecting the *kharif* paddy crop. Uncertainty of monsoons significantly reduces paddy yields and forces farmers to migrate to maintain household food security. Creation of a plethora of decentralized water harvesting structures such as the '5% Farm Pond' method will enable farmers to have protective irrigation during critical periods of moisture stress. Such simple water control mechanisms will not only improve the food security of millions of farmers; it will also reduce their dependence on forced migration during lean times and will encourage them to focus more on agriculture-based livelihoods.

Lifting devices such as low-cost, high-efficiency diesel pumps as well as manually-operated treadle pumps need to be encouraged and supported. The region has abundant streams and rivulets that can be harvested through small-scale lift-irrigation projects. At places where wells exist, low-cost micro-irrigation systems may be introduced to support women-managed vegetable cultivation on homestead lands.

Watershed Approach

Simultaneously, uplands may be taken up for soil-water conservation measures and for growing improved grasses, timber, host plants for silkworms/lac, and fruit trees. A series of such interventions undertaken together across the local topography [Figure 2] can have a positive impact on tribal livelihoods.

Figure 1: A series of interventions for paddy stabilization

Innovative Farming Technology

Innovative paddy management that can reduce water requirements and the cost of cultivation while boosting yields would be particularly well-suited to the local environments and should be explored. This describes the alternative management strategy known as the System of Rice Intensification (SRI). The dominant strategy for yield enhancement in the post-Green Revolution era has focused almost completely on introduction of high-yielding varieties of seeds and on the application of fertilizers and pesticides. In contrast, SRI is drawing attention world-wide as a set of paddy cultivation practices because it offers higher paddy yields while reducing the cost of cultivation and using less water. SRI is currently being promoted on a pilot scale with poor tribal and non-tribal farmers in Jharkhand by NGOs like CINNI, PRADAN, etc. The opportunities of SRI need to be vigorously explored in the State. Initial results from field pilot studies indicate that two factors are critical for the success of SRI, i.e., water control and labor availability.

SRI method of Paddy Cultivation is a recent introduction in the State. The early pilots and field trials by Government and non-governmental organizations have so far demonstrated the effectiveness of the method for significantly enhancing paddy productivity. Considering the cost-effectiveness and productivity potential of the method and its compatibility with existing production processes, it is proposed to initiate a rapid spread of SRI method among small and marginal farm holders.

While the prospect is obvious, field experiences have shown many challenges. First, there is a usual reluctance among farmers to adopt practices that are different from their conventional ones, especially regarding their main subsistence crops. Second, the present service infrastructure is not sufficient in many places. Even district towns do not have enough seed and fertilizer stores, and the existing ones are poorly stocked. Third, farmers have little access to knowledge and problem-solving services. Finally, they have little or no access to financial services, such as working capital for agriculture and term loans for farm-asset creation.

In order to effectively deal with the above challenges, NABARD's support is being increasingly sought to trigger processes of wider adoption of technology by ways of awareness generation, capacity-building of farmers and NGOs, organizing *in-situ* pilot demonstrations, supporting farmers to access critical farm implements such as weeders and sprayers, and mainstreaming technology adoption.

The Technology

System of Rice Intensification

The System of Rice Intensification (SRI) emerged in the 1980s as a synthesis of locally advantageous rice production practices encountered in Madagascar by Fr. Henri de Laulanié, a Jesuit priest who had been working there since 1961. It was Dr. Norman Uphoff from Cornell International Institute for Food, Agriculture and Development (CIIFAD) in Ithaca, NY, USA, who brought this method to the notice of outside world in the late 1990s. Today, SRI is being adopted in many states in India, and the response from farmers has been overwhelming, seeing the benefits of the method, notwithstanding the constraints.

SRI is not a technology, but a whole package of agronomic practices which together exploit the genetic potential of rice plants; create a better growing environment (both above and below ground); enhance soil health; and reduce inputs. SRI can increase rice yield, while using less water and lowering production costs (WWF, 2004). It uses all the usual agronomic practices for transplanted rice -- raising a nursery, transplanting, irrigating, weed management, and nutrient management -- but there are some drastic differences in how these are carried out. SRI utilizes the early growth vigor of young seedlings; facilitates less competition for light and nutrients; enhances resource-use efficiency (seeds, water, fertilizer, pesticides); brings down over-dependence on chemical fertilizers. This promotes healthy root growth and increased soil microbial activity, thereby enhancing soil organic matter content. The set of six simple practices such as planting young seedlings (10-12 days old), planting seedlings at wider spacing (25x25 cm), alternate wetting and drying during the plants' vegetative growth phase to keep soil moist; applying organic manures; weeding with *cono weeders* to aerate the soil and incorporate weed biomass; and crop protection by bio pesticides and bio control agents are emphasized

SRI is a combination of various practices that include changes in nursery management, time of transplanting, and water and weed management. It is a different way of cultivating the rice crop although the fundamental practices remain more or less the same as in the conventional method; it just emphasizes altering of certain agronomic practices from the conventional way of rice cultivation. These new practices are together known as System of Rice Intensification (SRI). SRI is not a fixed package of technical specifications, but a system of production with four main components, viz., soil fertility management, planting method, weed control, and water (irrigation) management. Several field practices have been developed around these components.

Important features of SRI

Low seed requirement
Since a single seedling is transplanted per hill at wider spacing, seed requirement is drastically reduced, by 80% of more.

Low water requirement
As there is no need to maintain standing water, irrigation requirements are 25-50% less.

Transplantation of tender young seedlings (8-12days)
Transplantation of young seedlings at a shallow depth (1-2 cm only) results in quick recovery from transplanting and the establishment and production of more tillers

Transplanting at wider spacing
Wider spacing (10 x 10 inches or 25 x 25 cm), allows enough sunlight to reach the leaves of each rice plant, so that all can carry out photosynthesis. Reduced competition for water, space and nutrients results in the spread of roots and the healthy growth of plants. (The wider distance can even be increased where there is high soil fertility, optimizing spacing between plants.)

Incorporating weeds into the soil while weeding
Weeding with a simple mechanical hoe helps to replenish soil nutrients with green manure. Working with a hoe or weeder also helps to aerate the soil which in turn helps in vigorous root growth. (First weeding is at 10 days after transplanting, followed by a minimum of 3 weedings at 10-12 day intervals.)

Organic manures in place of chemical fertilizers
Organic manures improve soil structure and also microbial activity, which make for better soil aeration and water retention. This helps in decomposing organic matter into nutrients, essential for plant growth.

Pest management without chemicals
Normally, with SRI the incidence of pests and diseases is lower as the plants are widely spaced and are healthier. In case there are pests or diseases, biological control methods or natural control measures can be applied to keep them under check.

The Initiatives

In India, several institutions including government, research/extension institutions and non-government organizations have taken initiatives to popularise SRI methods since 2003. Many civil society organisations (CSOs) have shown interest in promoting SRI in several states, which had significant impact among poor and tribal farmers. The Sir Dorabji Tata Trust (SDTT) is one such organization promoting SRI, with a focus on small and marginal farmers.These efforts, however, have been location-specific, restricted to a few States/rice-growing belts. Looking into the potential of SRI as an environment-friendly, input-saving and yield-enhancing strategy, the Government of India has included SRI as one of the components under its National Food Security Mission (NFSM).

NABARD’s Initiatives in Jharkhand

The Project
One of the key strategies to promote SRI technology is to focus on small and marginal farmers, involving necessary capacity-building and technical advice through on-site technical guidance and credit/financial support. Such intervention is critical both from improving the individual farm income and for overall production of rice at macro level. Taking these aspects into consideration

and from discussion with SDTT and implementing NGOs like WASSAN, PRADAN and others, NABARD has worked out a model for coverage of 600 farmers by each project implementing agency (PIA), with an area coverage of about 150 acre in two years, spread across 24 villages. With a view to promote SRI technology in paddy among the maximum number of farmers in Jharkhand, NABARD is implementing a grant-based pilot project in Jharkhand, using the services of 52 experienced NGOs, covering 21 districts across the state. The project is targeted to cover 29,406 farmers, covering 7,456 acres of paddy land with grant support of Rs. 495 lakh for 2 years, 2010 and 2011, commencing from kharif 2010 (Annexure 1).

Salient Features

- The project envisages involvement of 52 NGOs across 21 districts of Jharkhand State.
- The project envisages involvement of 5 experienced and technically qualified NGOs as Resource NGOs.
- Each Resource NGO is to guide, sensitize, provide technical support, and co-ordinate the implementation of the program of the NGOs that are associated with it.
- Under the pilot project, each implementing NGO would be supported with grant assistance from NABARD to promote SRI paddy cultivation among 600 farmers in 24 villages over a period of 2 years, covering 25 decimals of paddy land per farmer. While NGOs can cover more number of villages, the number of farmers per village will be restricted to 25.
- Resource NGOs would train the implementing NGOs regarding operational aspects of the scheme, SRI techniques in detail, provide promotional material in print form, flip charts, audio visuals, etc.
- Implementing NGOs are required to adhere to a uniform code of implementation including farmer wise monitoring system and adherence to a comprehensive Management Information System (MIS) developed by Resource NGOs and NABARD.
- Each NGO is expected to cover upto 200 farmers in year I and 400 farmers in Year II as part of the project. Proposals from implementing NGOs for support in year II will be considered only on the basis of their performance during year I.
- As per the model project designed jointly by NABARD and NGOs, the grant assistance for coverage of 200 farmers in year I would be Rs.3.45 lakhs, and for year II it would be Rs.6.51 lakhs to cover 400 farmers (Annexure 2).
- Implementing NGOs are required to form Farmers' Clubs in each village where the scheme is being implemented for which the NGOs can apply for financial support under the normal NABARD scheme for Farmers' Clubs by submitting their proposal to the DDM in the district. Further, the NGOs are required to submit district-wise details of Farmers' Clubs already promoted by them to their Resource NGOs, giving full details covering name of club, name of village, name of chief volunteer and associate volunteer, date and number of sanction letter from NABARD, and details of reimbursements received from NABARD with date.
- Implementing NGOs are required to form at least 50 Joint Liability Groups (JLGs) of farmers per village (groups of 5-10) for availing of crop loans (KCC) from banks. NGOs are eligible for grant assistance from NABARD for formation of JLGs to the extent of Rs.2,000/- per JLG, and the proposals in this regard are to be submitted to the District Development Manager (DDM) in the concerned district, where the JLGs are formed.
- Implementing NGOs are required to furnish district-wise data on SHGs promoted by them on the proforma to be provided by NABARD and submit it to their Resource NGO. Resource NGOs are required to forward the data received from NGOs to NABARD Regional Office in Ranchi.

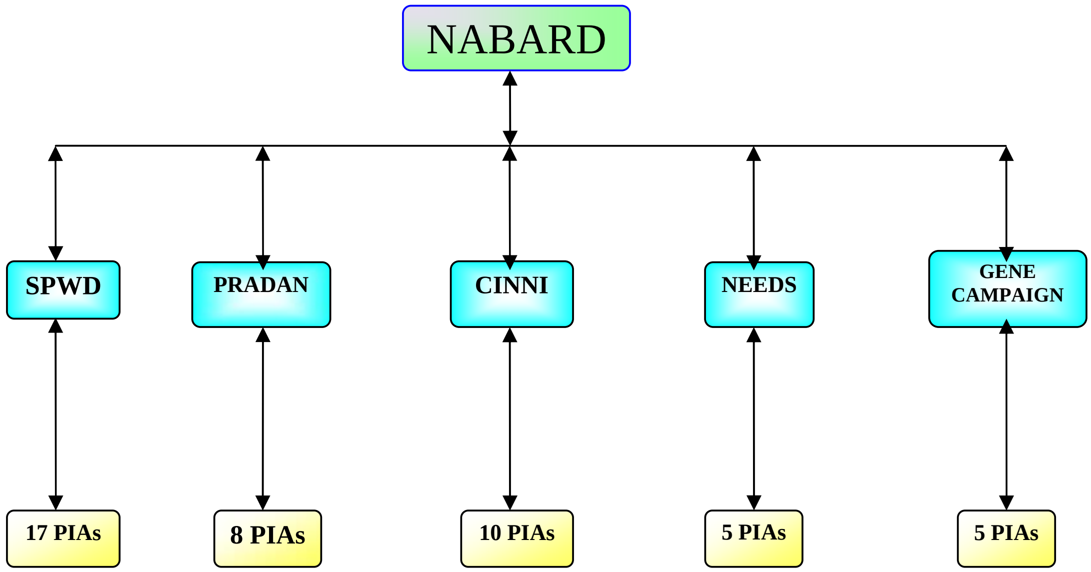

Fig 2. Flowchart for implementing organisations

Grant Coverage

- The grant for SRI work covers the items indicated in Annexure 2, which are:
- Cost of training and exposure of farmers
- Input cost to cover supply of mechanical weeders and sprayers @1 set for each group of 8-10 farmers.
- Publicity and extension (tools and materials)
- Dissemination of knowledge and learning
- Assessment of important documentation
- Capacity-building training and exposure of implementing NGO staff
- Monitoring and maintenance of MIS and reporting system
- Extension support and field support

Partner Agencies

The programme is to be implemented through NGOs having necessary experience, infrastructure, and technically-qualified manpower. In states where the SDTT programme is being implemented, the ROs and implementing agencies may coordinate for sharing of views and expertise and ensure non-overlapping of programme implementation areas.

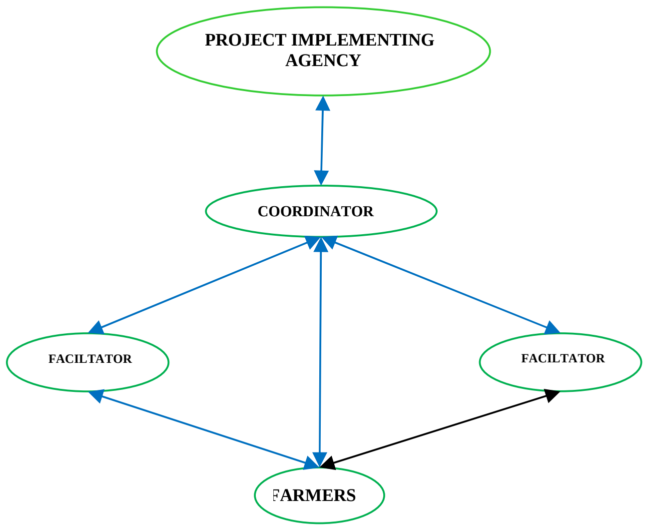

Fig 3. Flowchart for implementation status

Role of Partner Agencies

- Conduct demonstrations/training programmes and motivation of farmers to adopt SRI
- Identification farmers in selected villages, and preparation of project proposal
- Capacity-building of facilitator, programme co-ordinator, and participating farmers
- Conduct video shows, mass meetings, etc., printing and distribution of pamphlets
- Facilitate provision of inputs (seed, fertilisers, manures etc.) to participating families through SRI Facilitator/Programme Co-ordinator
- Arranging equipment like markers, weeders, etc., to identified farmers.
- Structured visits to the farmers for on-site advisory services
- Monitoring of progress and reporting on a monthly basis to NABARD
- In states where it is operating, SDTT would facilitate with the MIS and documentation of success stories.

Model Cost

Input support to farmers

With a view to motivate farmers to adopt SRI, it is proposed to provide input support of Rs.793 per farmer in the first year (for new farmers). This support is basically to meet the cost of fertiliser, marker, sprayer (1 for every 8 farmers), weeder (1 for every 5 farmers), organic manure, etc. that are considered to be critical inputs for enabling adoption of the technology. The break-up details are as below:

Table 11 Item-wise breakup of input support to farmers

Sl.No	Particulars	Rate (Rs)	Cost per farmer (Rs)
1	Weeder for a group of 5 farmers	1,500	300
2	Green manuring		200
3	Sprayer for a group of 8 farmers	1,100	138
4	Critical inputs (potash, bavistin, phosphate)	155	155
	Total		**793**

Training and awareness creation

For training of farmers, a provision of Rs. 310 per farmer has been made. This includes video shows, demonstrations, brochures, etc., with details as below:

Table 12 Support for input cost and promotional materials		
Sl No	Particulars	Cost per farmer (Rs)
1	Technical training/capacity building	150
2	Workshop/*Kisan mela*	65
3	Baseline survey	15
4	Record-keeping and documentation	325
5	Salary of SRI facilitator, SRI coordinator, administrative costs, mobility support & overheads (for NGOs)	810
6	Promotional materials	90
	Total	1455

Cost of Project Implementation Team

The entire programme will be driven by the local-level Facilitator, who will provide technical and moral support to the sample farmers in nursery raising, marking fields, transplantation, weeding, water management, etc. One Facilitator will cover four villages, and hence the services of two Facilitators in the first year and four Facilitators in the second year will be employed. A remuneration of Rs.3,000/- per Facilitator per month has been provided, and the total cost of Facilitators for the first year comes to Rs.72,000/-.

The Programme Coordinator will be the key person at the unit level, coordinating the activities of the Facilitators ensuring adoption by the farmers. A provision of Rs.60000/- per year is made towards the salary of the Programme Coordinator. In order to ensure proper mobility of the Programme Coordinator and Facilitators, travelling cost at Rs.5,000/- per month has been provided for. An amount of Rs. 6,000/- per year per unit is provided to the participating NGOs towards administrative overheads.

The overall cost for the indicative model covering 600 farmers, works out to Rs. 9.96 lakh over a two-year period (Annexure 2).

Monitoring Mechanism & Documentation

A comprehensive Monitoring Information System (MIS) will be made use of for effective monitoring of the programme implementation. Since documentation of quantifiable benefits is crucial under a SRI technology adoption programme, the MIS provides for capturing the farmer-wise data on variety of aspects such as area cultivated, practices followed, grain yield, straw yield, innovations, constraints, etc. through the specified format. The Programme Coordinator and Facilitators will facilitate data collection from the participating farmers and documentation of the same.

In order to coordinate monitoring of the programme in the State, a State-level Nodal Agency will be constituted. This agency will check the monitoring reports submitted by NGOs and in turn will submit a comprehensive report to the Regional Office of NABARD, which in turn will submit a report to the NABARD Head Office. At Head Office-level, it is proposed to have a Steering Committee on SRI, which will meet at half-yearly intervals to review the progress.

Results

Rainfall Status of the State

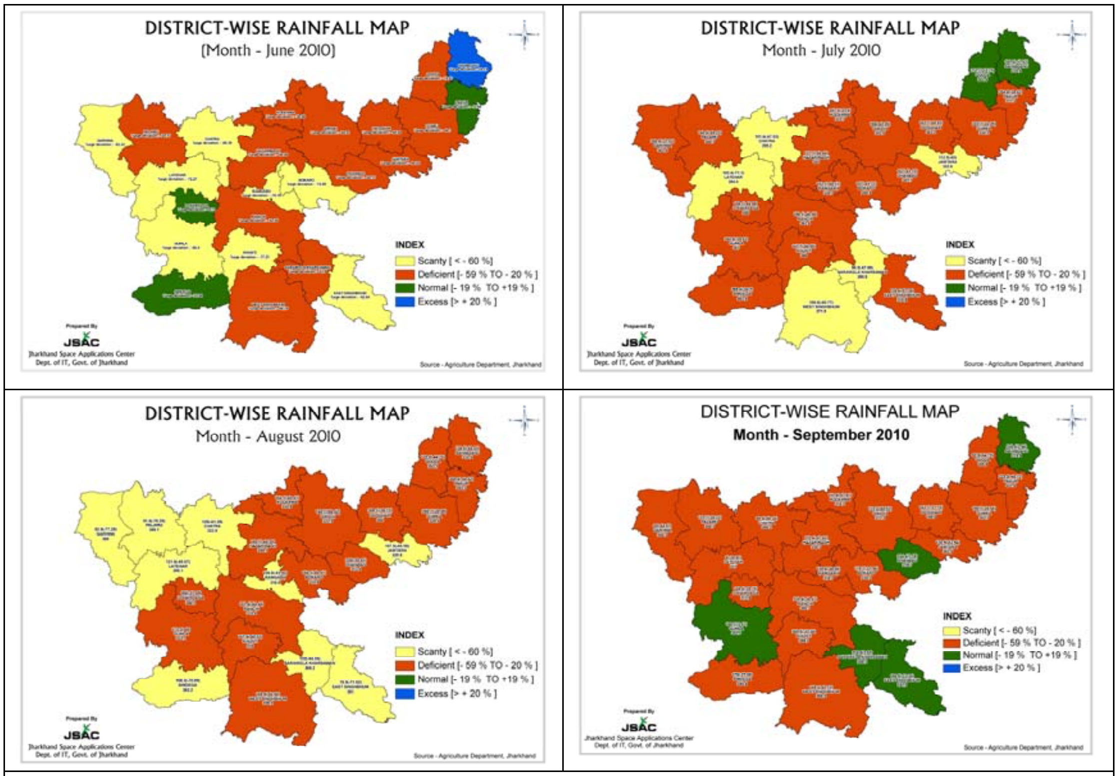

Fig 4. Rainfall status of Jharkhand state

Table 13. Rainfall Status of Jharkhand: April – Sept. 2010 (in mm)

Month	Normal	Actual	Deficiency	Deficiency
April	22.3	3.4	18.9	84.7%
May	44.9	30.7	14.2	31.6%
June	196.5	100.1	96.4	49.1%
July	321.6	178.7	142.9	44.4%
Aug	322.5	166.8	155.7	48.3%
Sept *	234.8	73.3	161.5	68.8%
Total	1142.6	503.7	638.9	54.5%

*** up to 15/09/2010**

It is evident there was a drastic overall rainfall deficiency in the state, to the extent of 55% during kharif crop 2010 (Table 13). Of the total kharif cropping area in Jharkhand of 20 lakh hectares, at least 12 lakh hectares (more than 50 %) received minimal rainfall (Fig 4). Faced with an acute scarcity of rain water, crops sown on this belt, particularly paddy, were hit badly. In Jharkhand, only 28% of sowing took place during the year (IANS). The state government declared the entire state as drought-affected (IANS). The problem of farmers can be seen from the fact that only 12% of farmers irrigate their land through canals and other irrigation methods, against the national average of 40%. This helps explain why Jharkhand currently produces only half of the foodgrains of its total consumption.

Table 14.
District-wise Rainfall Deficiency during July to Sept. 2010

District	Agroclimatic subzone	Rainfall deficiency (%)	Status: Excess (E), Deficiency (D), Normal (N), Scanty (S)
Sahebganj	IV	27.5	D
Dhanbad	IV	27.7	D
Dumka	IV	33.0	D
Pakur	IV	36.9	D
Godda	IV	37.0	D
Deoghar	IV	39.1	D
Bokaro	IV	39.5	D
Koderma	IV	39.6	D
Hazaribagh	IV	49.0	D
Giridih	IV	51.8	D
Ramgarh	IV	52.8	D
Jamtara	IV	62.5	S
Gumla	V	30.2	D
Khunti	V	42.9	D
Ranchi	V	43.5	D
Simdega	V	43.7	D
Lohardaga	V	44.9	D
Garhwa	V	59.8	D
Palamu	V	61.1	S
Chatra	V	63.3	S
Latehar	V	76.1	S
Saraikela Kharsawan	VI	49.1	D
East Singbhum	VI	51.5	D
West Singbhum	VI	52.9	D

Out of 24 districts in the state, 20 districts experienced deficient rainfall, ranging from 27.5 to 59.8 percent, and 4 districts received scanty rainfall ranging from 62.5 to 76.1 percent of normal (Table 14). The erratic rainfall played havoc with the sowing, nursery raising, and transplanting. In many cases, seedlings could not be transplanted in time, and in some cases transplantation was done after 20-25 days in nursery. In some cases, nursery had to be planted successively for the 3rd time.

Farmer coverage
The project was designed to cover 9,806 farmers with an area coverage of 2,462 acre during the first year. However, due to draught-like situations and erratic monsoon, 5,195 (53%) farmers compared to the target number to be covered during the 1st year under the SRI programme. This may be an encouraging outcome considering that the overall transplantation of paddy in the whole state was recorded to be 29% of the total paddy-growing area during kharif 2010.

Area coverage (target vs. achievement)
Due to draught-like situations and erratic monsoon, 1184.53 acres of paddy-growing area out of a target of 2,462 acres could be covered during the season. This was 48% of the targeted area to be covered during the 1st year under the SRI programme.

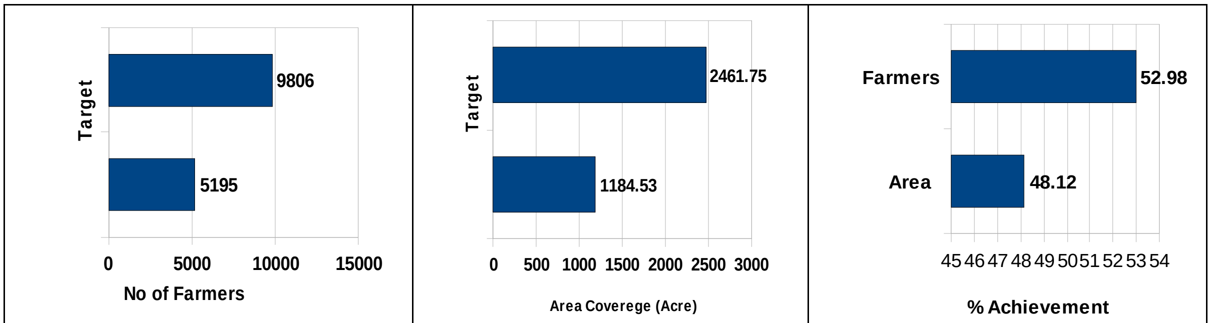

Fig 5. Overall targets vs. achievement in terms of number of farmers and area coverage

District-wise coverage of farmers

The district-wise coverage of farmers as seen in Figure 6 reflects highest relative achievement in the district of Chatra vis-à-vis the programme targets. However, in absolute terms, the largest number of farmers covered was in Deoghar (1,336), followed by the districts of Hazaribag (793) and Ranchi (596). The lowest level of achievement was recorded in the in the districts of Latehar (12%), Gumla (30%), and West Sigbhum (46%).

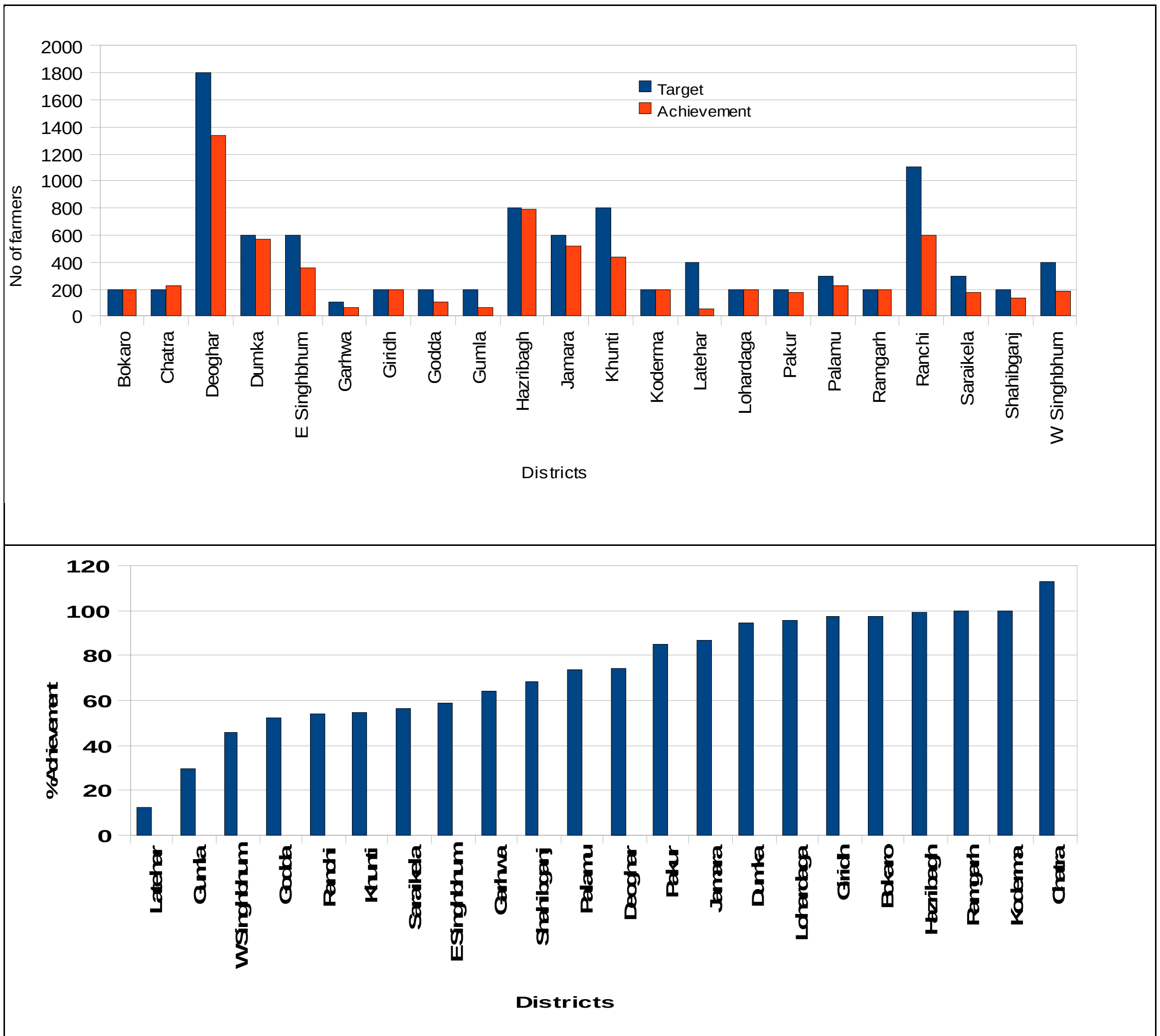

Fig 6. Targets vs. achievement in terms of number of farmers

District-wise area coverage
The district-wise targets in respect of area coverage were highest in the district of Lohardaga followed by Pakur, Bokaro and Palamu (>80%), and then Jamtara, Deoghar, Sahibgung and Dumka (60-80%). The least coverage were observed in East Singbhum (<10%). In absolute terms, the area coverage was greatest in Deoghar (323.35 acres) followed by Jamtara (116.5 acres), Ranchi (99 acres) and Dumka (98.58 acres), respectively (Fig 7).

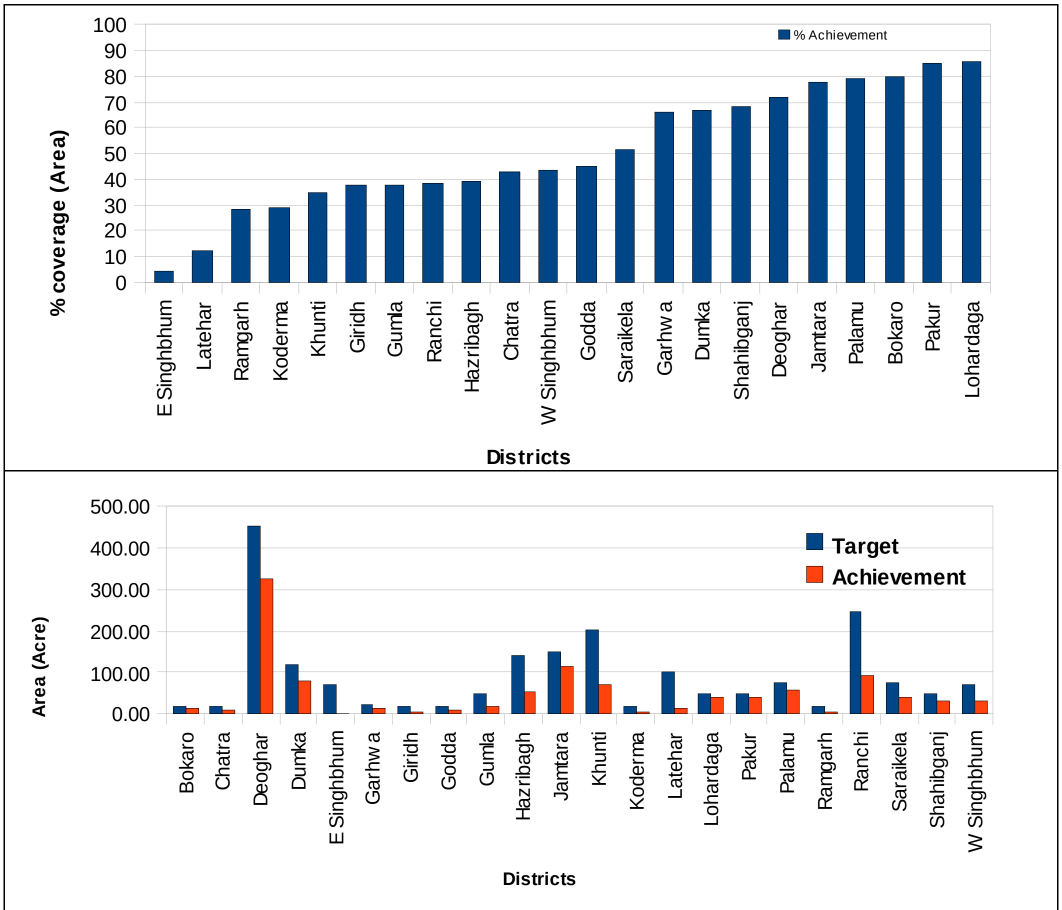

Fig 7 Targets vs. achievement in terms of area coverage

Subzone-wise area coverage
The agroclimatic subzone-wise area coverage was greatest in zone IV (704 acres), followed by zone V (315 acres) and zone VI (7.3 acres). The subzone-wise data coverage was to the extent of 46% in zone IV, followed by 30% in zone V and 24% in zone VI (Fig 8).

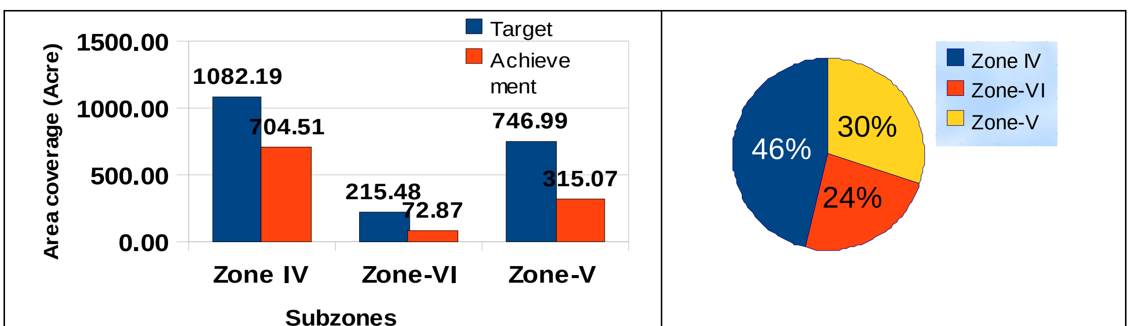

Fig 8. Subzone-wise area coverage

Subzone-wise coverage of farmers

The agroclimatic subzone wise coverage of farmers reflects maximum in zone IV (4640) followed by zone V (1622) and zone VI (705). The subzone coverage of farmers was highest in zone IV (45%) followed by zone VI (28%) and zone V (27%) (Fig 9)

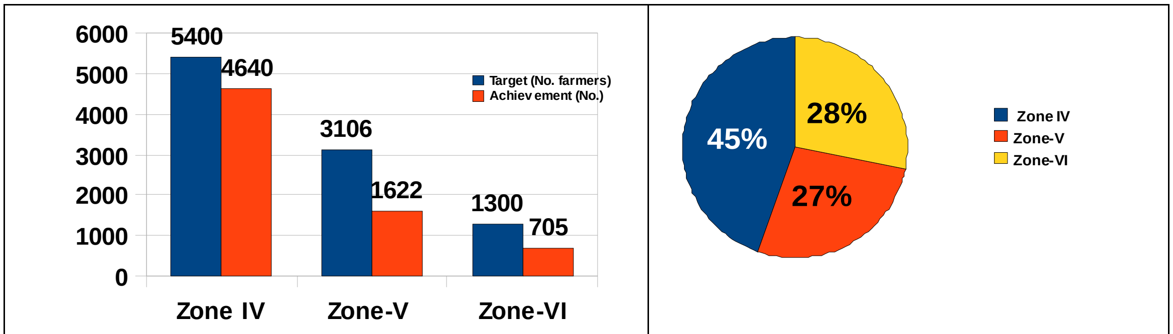

Fig 9. Subzone-wise area coverage of farmers

3. Yield Attributes

Yield characteristics: traditional vs. SRI

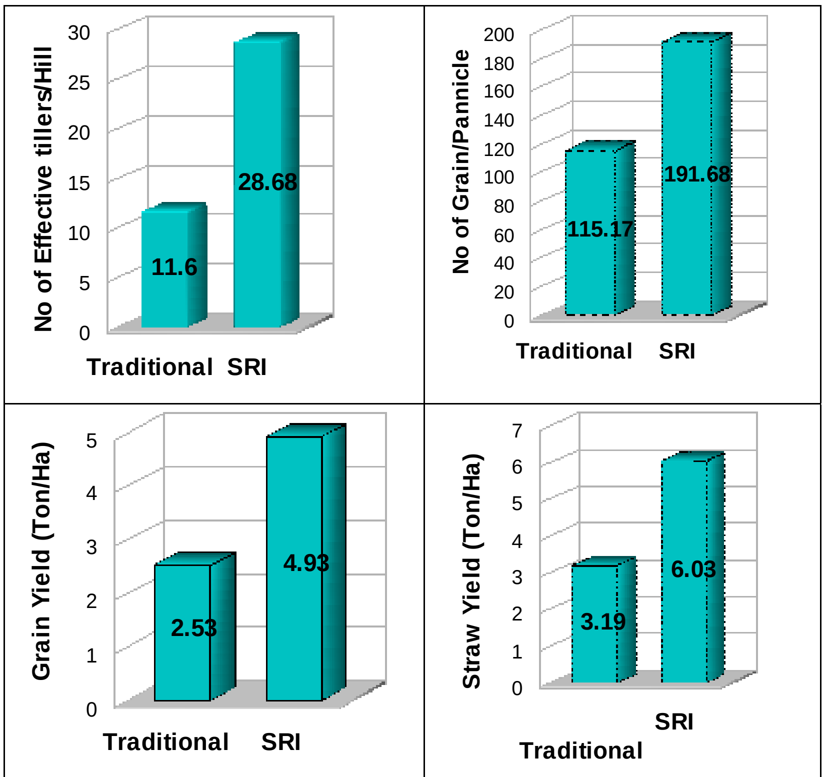

Fig 10. Yield characteristics with traditional vs. SRI methods

The analysis of yield characteristic was done using pooled data from all the three agroclimatic subzones and for all the three landtypes (upland, midland and lowland), irrespective of variety. The data were separated by analysis for each subzone as well as landtype for comparison. The yield characteristics of all the paddy varieties used under the project were also analysed for different landtypes and are presented here land type-wise as well as in pooled terms. In all cases, data analysis comparisons have been made between traditional and SRI methods of cultivation. The analysis of pooled data, representing all the paddy varieties, all the landtypes and all three agroclimatic zones, was done for following four parameters.

1. Number of effective tillers per hill
2. Number of grains per panicle
3. Grain yield
4. Straw yield

The data show that average number of effective tillers per hill for SRI was 28.68, which was much higher in comparison to traditional methods of cultivation (11.6). The average number grains per panicle with SRI methods was 191.68 as against 115.17 with traditional methods of cultivation. Grain yield with SRI was recorded as 4.93 mt/ha as compared with 2.53 mt/ha with traditional methods. Straw yield of 6.03 mt/ha was recorded in SRI, while 3.19 mt/ha was obtained with traditional methods of cultivation.

Land type-wise yield characteristics in traditional and SRI methods

The analysis of all four yield parameters was done respectively for all the three landtypes. The results indicate a general trend across the land types related to the SRI mode of cultivation. Highest productivity was seen in lowland paddy cultivation followed by midland and upland regions. The number of effective tillers in the case of SRI, however, did not reveal any clear trend (Fig 11). As regard the yield attributes of traditional paddy cultivation, a similar trend was witnessed with respect to grains/panicle and grain yield. However, no clear trend was discernable with regard to the other two yield parameters.

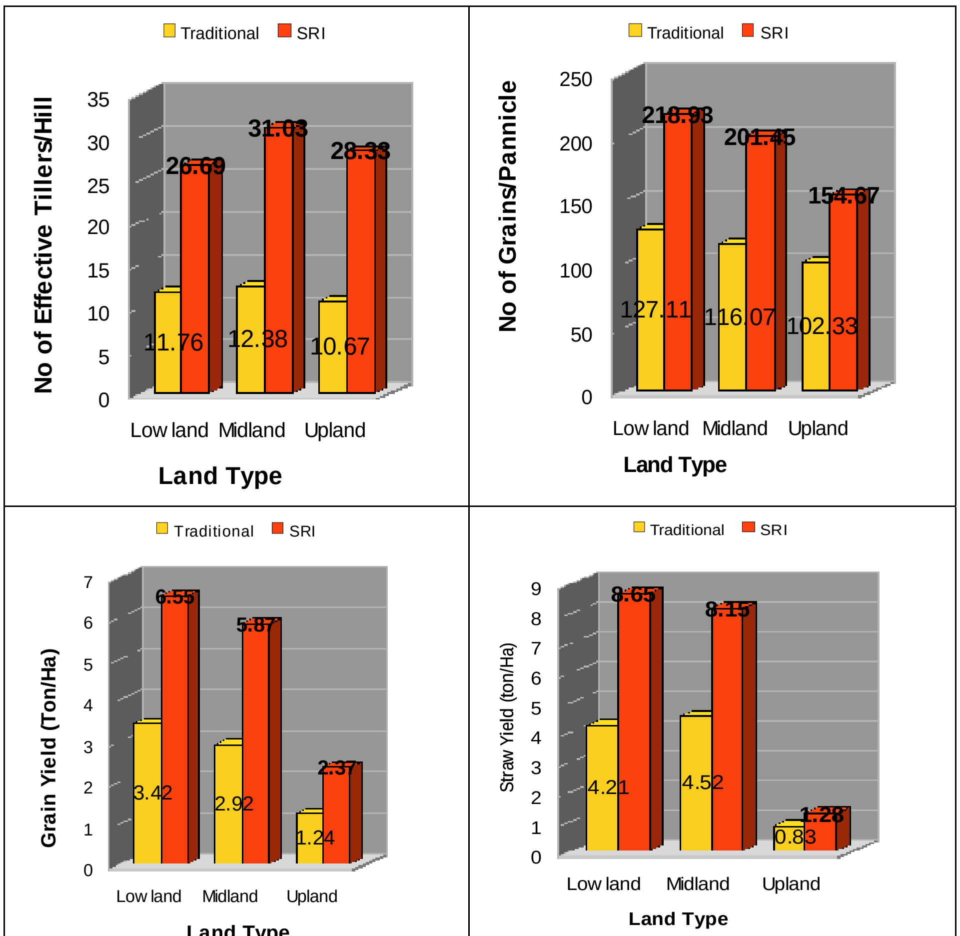

Fig 11. Landtype-wise yield characteristics: Traditional vs. SRI methods

Subzone-wise yield characteristics: Traditional vs. SRI methods

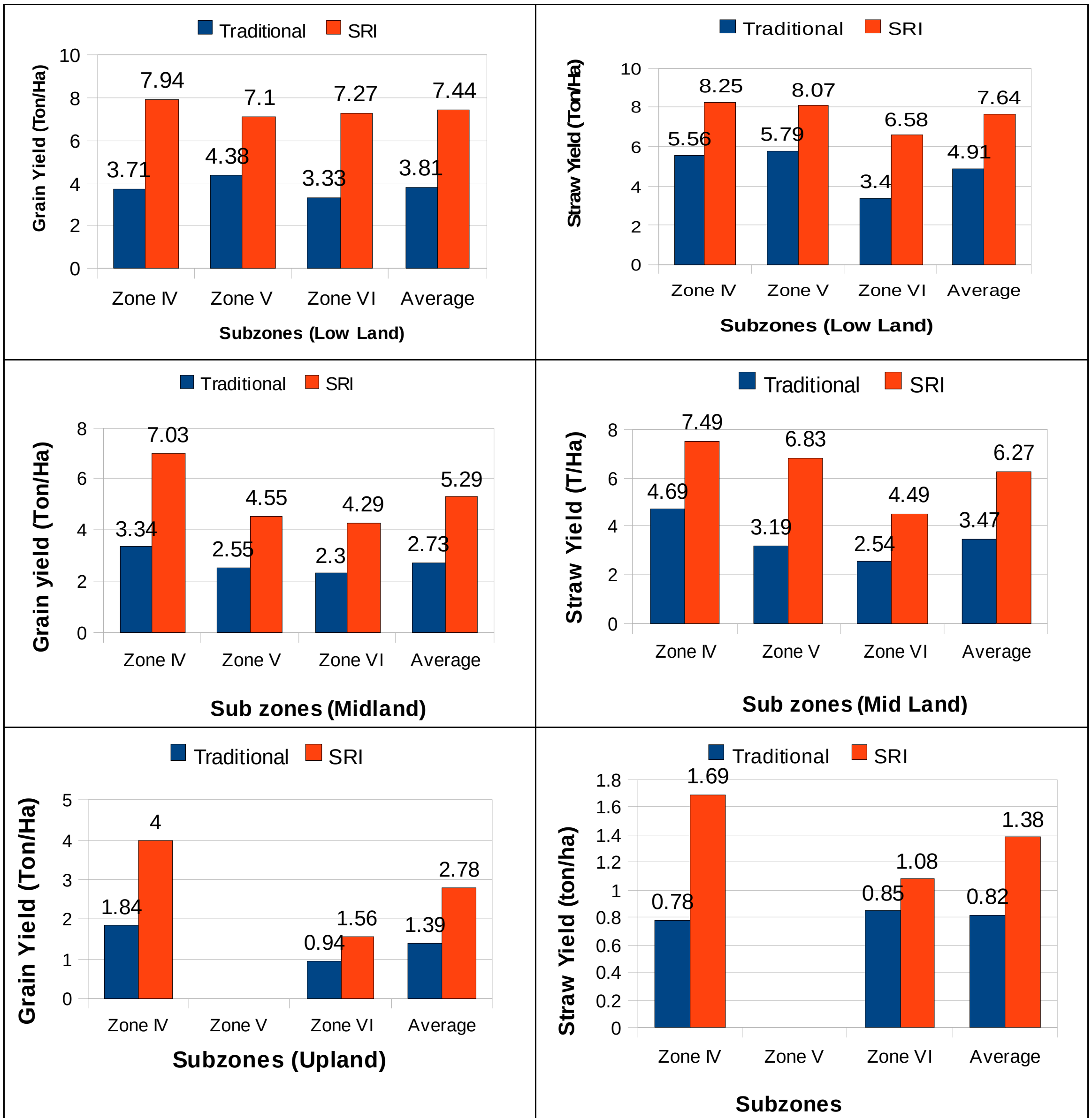

Fig 12. Subzone-wise yield characteristics with traditional vs. SRI methods

Yield attributes, viz. grain yield and straw yields, were further analysed according to agriclimatic subzones for all three landtypes. It was observed that in case of SRI, the grain yield and straw yield were highest in zone IV for all the three landtypes, followed by zone V and zone VI, except in lowland situations wherein zone VI gave higher yields than zone V. The trend is deviated from in the case of upland paddy for lack of data in respect of zone V. Similar trend was also deviated from in respect of straw yield in midland paddy. However, no such clear trend emerged for other the two landtypes (Fig 11).

4. Performance of Different Paddy Varieties

The performance of all the paddy varieties in terms of the four yield attributes was analyzed for all the three landtypes, and yield advantage of SRI, if any, over traditional paddy cultivation was discussed for each paddy variety for each landtype.

Performance of paddy varieties in terms of tillering

Tillering is one of the important factors which can increase rice productivity, and it is profuse in the case of SRI due to the timely weeding mandated in the SRI technique. In case of normal paddy cultivation, the tillers are very less in number, hardly 8-10 per plant, whereas, in the case of SRI, 20 or more tillers is a normal occurrence. However, the important consideration is the number of productive tillers per unit area rather than per plant, as determines the crop productivity. The average number of productive tillers is seen in Figure 12) showing differences between the different varieties of paddy.

Variety-wise number of effective tillers per hill (traditional vs. SRI)

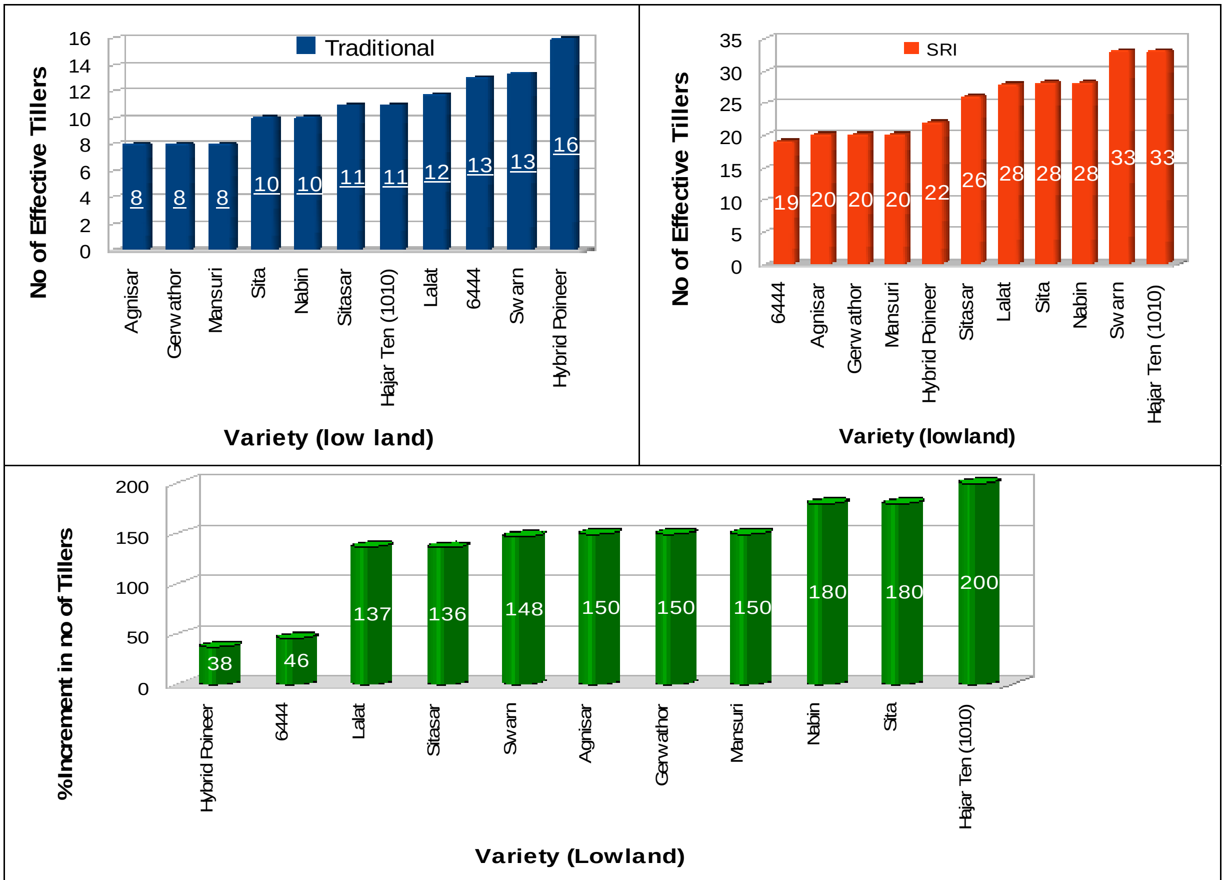

Fig 13. Variety-wise effective tillers/hill under lowland conditions (traditional vs. SRI)

As may be evident, the lowest average number of tillers per hill (8) was observed in the case of Agnisar variety, and the highest average tiller number (16) was observed in case of Hybrid Pioneer under lowland situation using traditional practices. The analysis of data in respect of SRI indicates the lowest average number of tillers in the case of variety 6444 (19) and the highest average was for Hajar Ten (1010) (33) under lowland cultivation. There was incremental increase in the number effective tillers in all varieties when using SRI method of cultivation, ranging from 38% to 200%

Variety-wise number of grains per panicle (traditional vs. SRI)

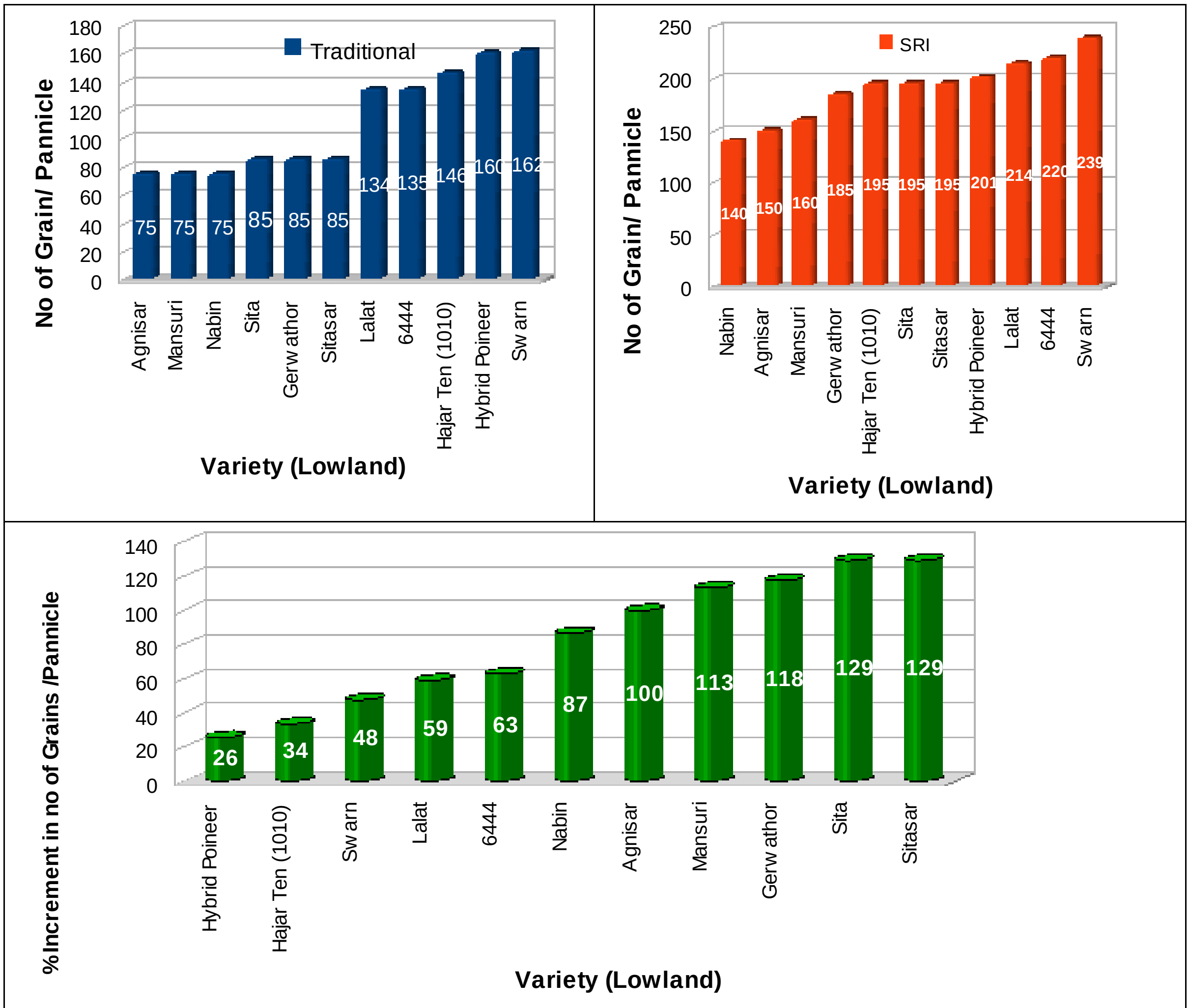

Fig 14. Variety-wise grains/panicle under lowland cultivation (traditional vs. SRI)

Regarding production of number of grains/panicle, it was observed that following traditional methods, Agnisar presented the lowest number of grains per panicle (75) and Swarna presented the highest number (162); under SRI methods in lowland situation, Nabin presented the lowest number of grains per panicle (140) and Swarna presented the highest number (239). The incremental increases in grains per panicle under SRI management ranged from 26 to 129 percent across all the varieties (Fig 12).

Variety-wise grain yield under upland cultivation (traditional vs. SRI)

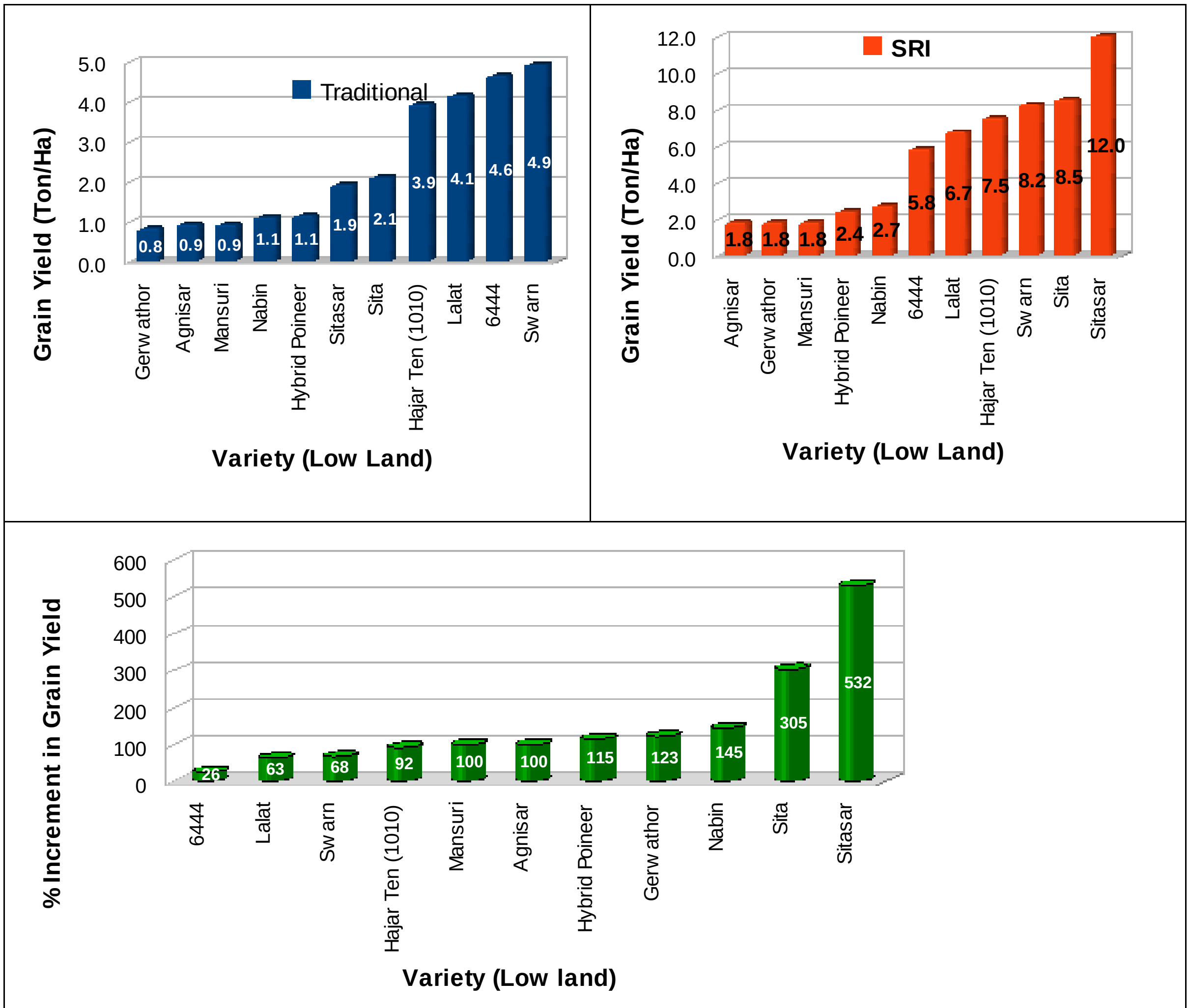

Fig 15. Variety-wise grain yield under lowland cultivation (traditional vs. SRI)

It was observed that under traditional methods of cultivation, highest grain yield production was recorded with Swarna variety (4.9 mt/ha) while lowest grain yield was recorded with Gerwathor variety (0.8 mt/ha). Under SRI method of SRI cultivation, highest grain yield was recorded with Sitasar variety (12 mt/ha) and the lowest yield with Agnisar variety (1.8 mt/ha). Percent increments in grain yield with SRI over traditional methods ranged from 26 to 532 percent under lowland conditions (Fig 15).

Variety-wise straw yield under upland cultivation (traditional vs. SRI)

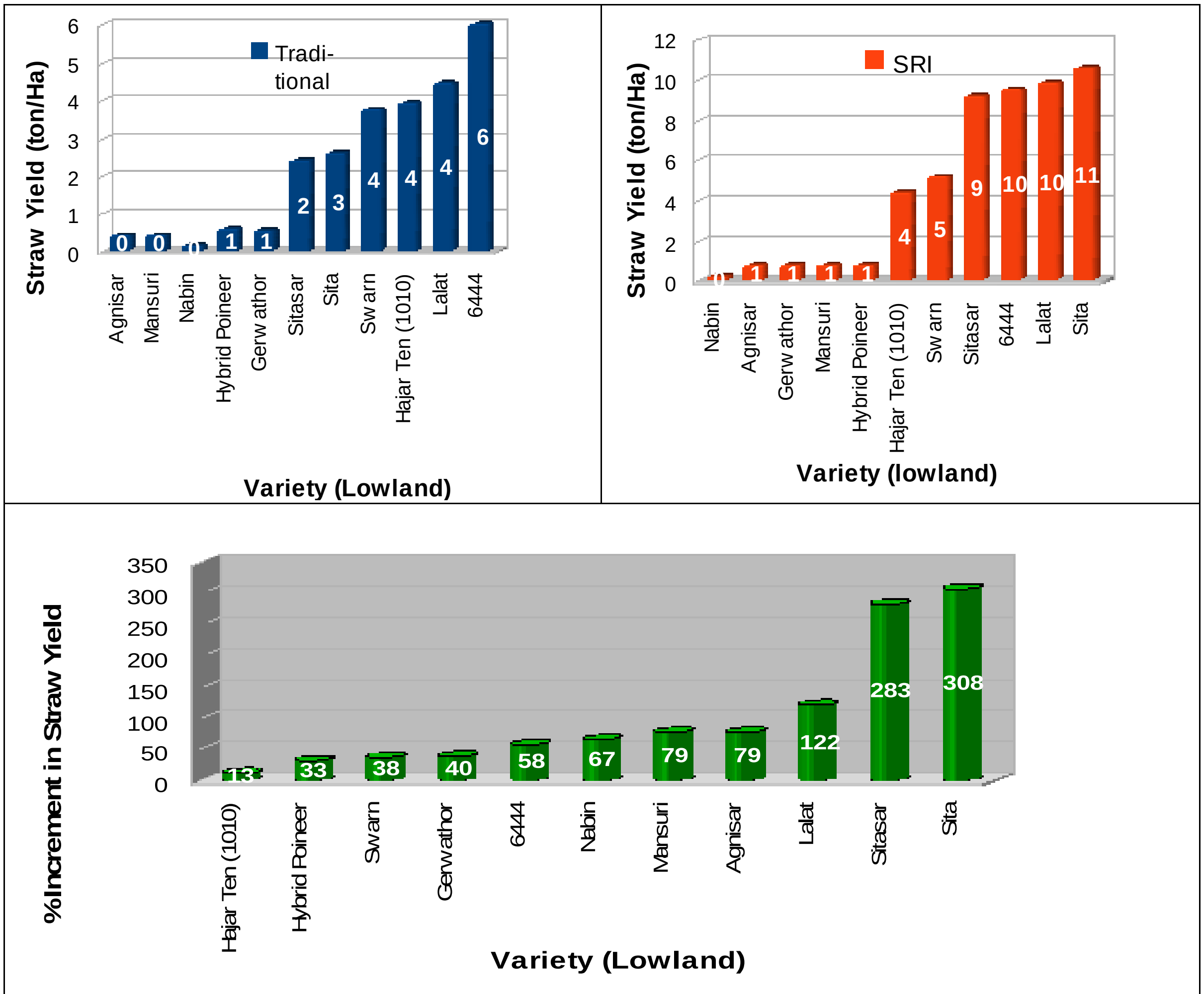

Fig 16. Variety-wise straw yield under lowland cultivation (traditional vs. SRI)

It was observed that under traditional methods of cultivation, highest straw yield production was recorded with variety 6444 (6 mt/ha), while the lowest straw yield was recorded with Hybrid Pioneer (1 mt/ha). Under SRI methods of SRI cultivation, highest straw yield was recorded with Sita variety (11 mt/ha) and the lowest yield with Agnisar variety (1 mt/ha). Percent increment in straw yield from SRI management over traditional methods ranged from 13 to 308 percent under lowland conditions (Fig 16).

Variety-wise number of effective tillers per hill under midland cultivation (traditional vs. SRI)

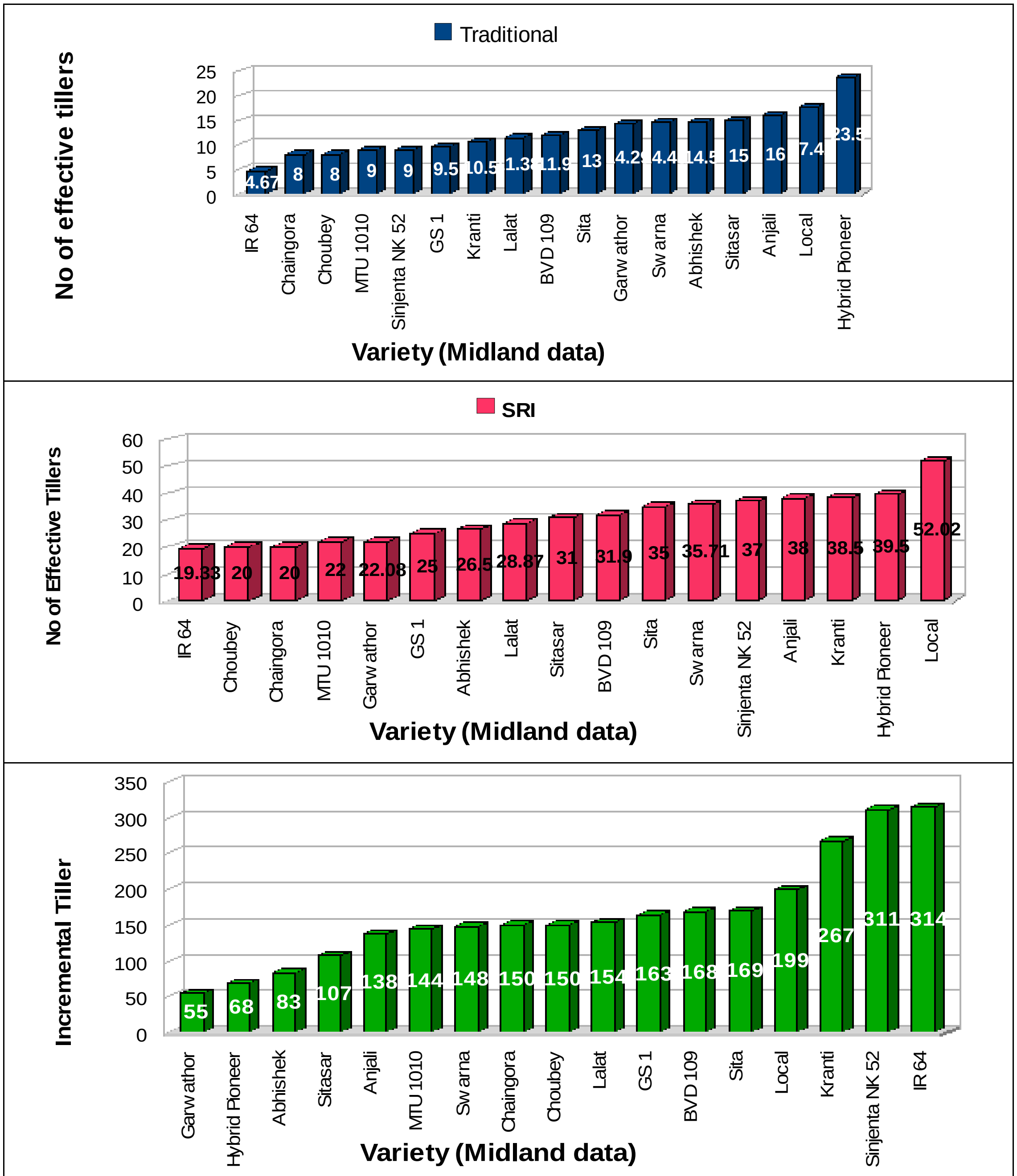

Fig 17. Variety-wise number of effective tillers in midland cultivation (traditional vs. SRI)

Using traditional practices under midland situation, lowest average number of tillers per hill (5) was observed in the case of IR 64 and the highest average tiller number (23) was observed in case of Hybrid Pioneer. The analysis of data with respect to SRI management indicates that the lowest average tiller number was for variety IR 64 (19) and highest average was with a local paddy variety (52). There was incremental increase in effective tiller production for all varieties using SRI methods of cultivation ranged from 55% to 314%.

Variety-wise number of grains per panicle under midland cultivations (traditional vs. SRI)

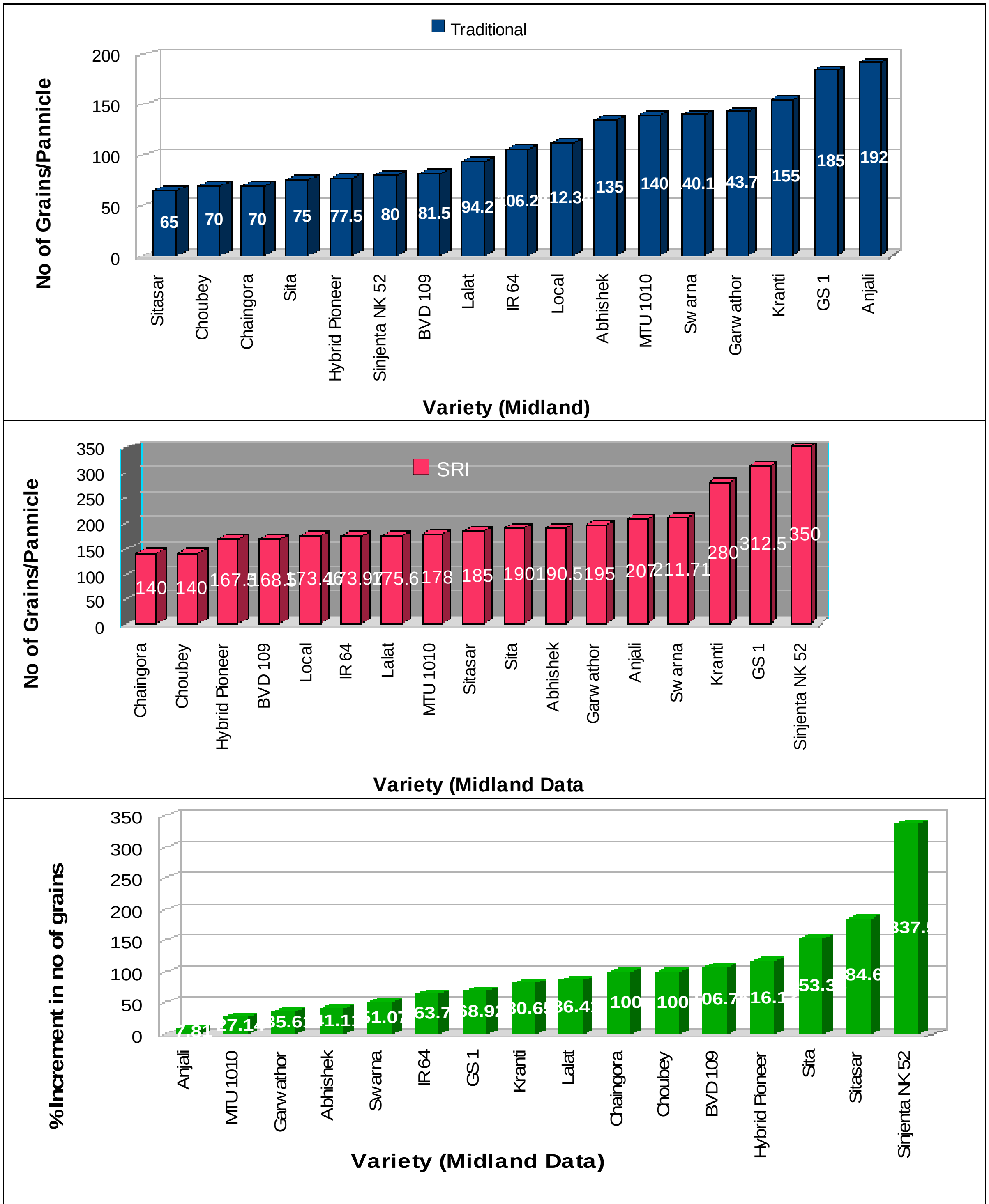

Fig 18. Variety-wise number of grains/panicle under midland cultivation (traditional vs. SRI)

Following traditional methods in midland areas, the number of grains/panicle was observed to be lowest with the variety Sitasar (65), while the highest number of grains per panicle was with Anjali (192); meanwhile in midland conditions with SRI management, Chaingora had lowest number of grains per panicle (140), and Sirienta NK 52 the highest (350). The increase in grains per panicle under SRI ranged from 8 to 337 percent across all varieties (Fig 18).

Variety-wise grain yield under midland cultivation (traditional vs. SRI)

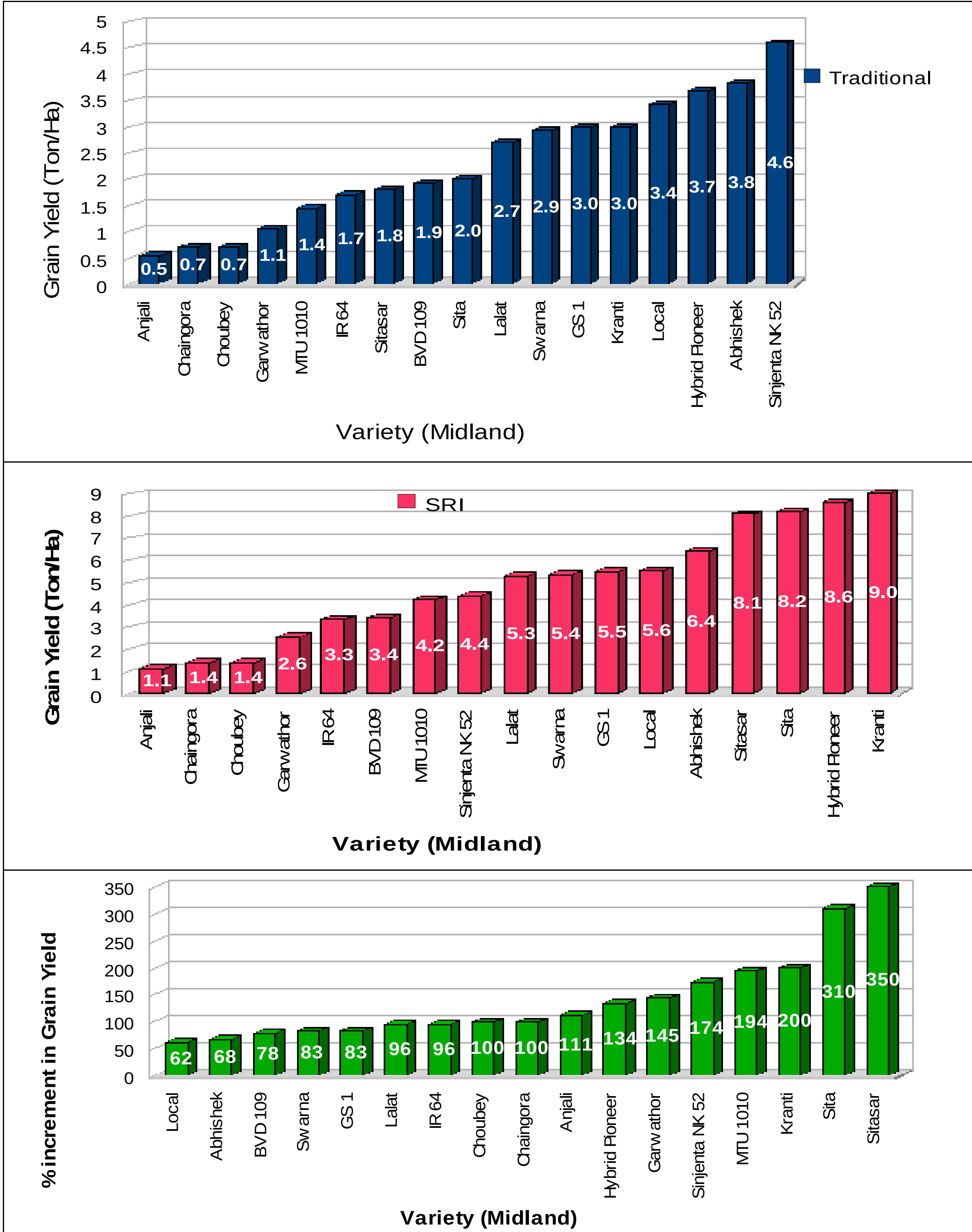

Fig 19. Variety-wise grain yield under midland cultivation (traditional vs. SRI)

It was observed that highest grain yield production with traditional methods of cultivation in midland farming was recorded with Sinjenta NK52 variety (4.6 mt/ha), while lowest grain yield was recorded with Anjali variety (0.5 mt/ha). Under SRI methods of cultivation, the highest grain yield was recorded with Kranti variety (9 mt/ha) and the lowest yield with Anjali variety (1.1 mt/ha). The percent increment in grain yield with SRI over traditional methods ranged from 62 to 350 percent under midland conditions (Fig 19).

Variety-wise straw yield in midland cultivation (traditional vs. SRI)

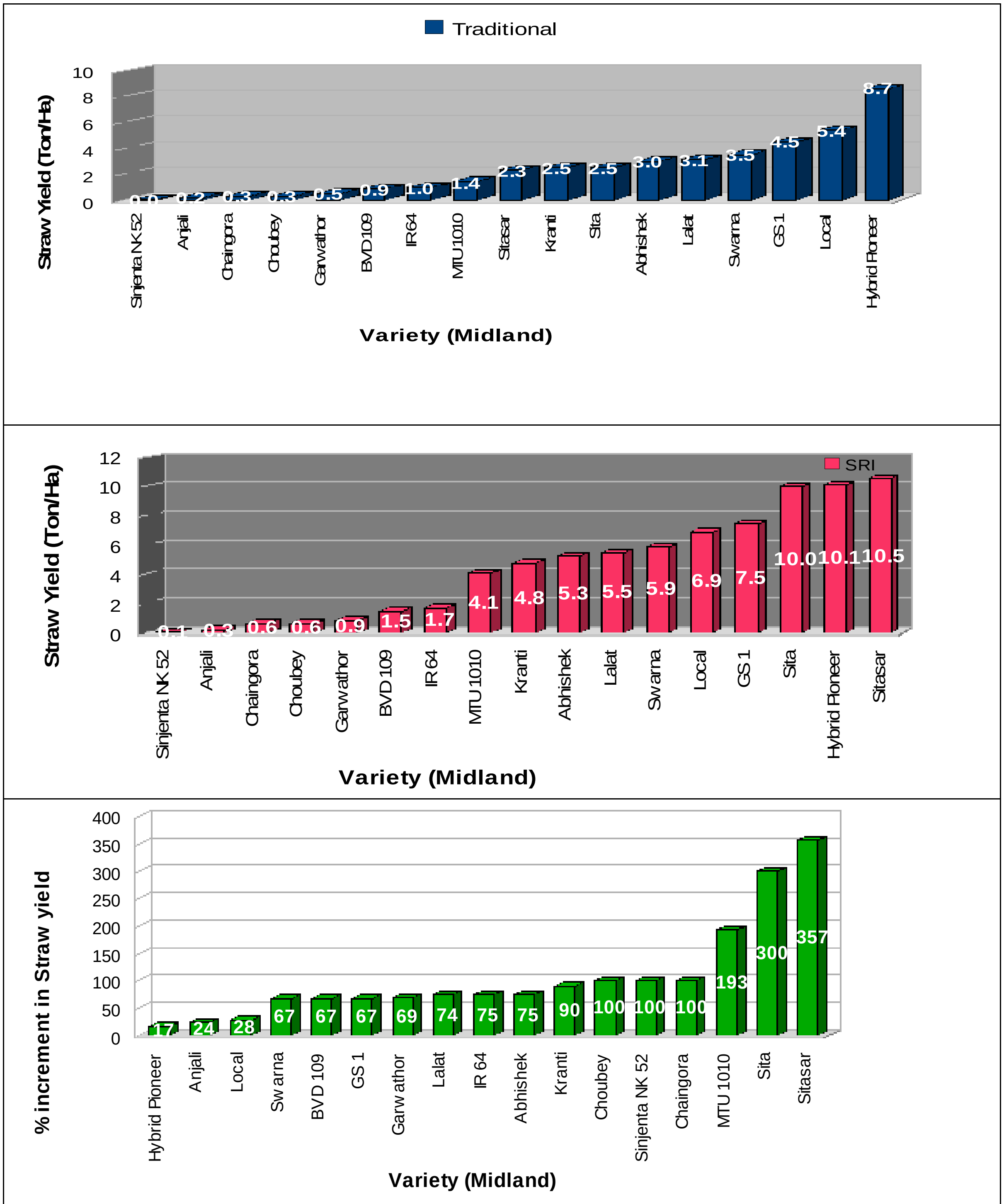

Fig 20. Variety-wise straw yield under midland cultivation (traditional vs. SRI)

It was observed that with traditional methods of cultivation in midland areas, the highest straw yield production was recorded in Hybrid Pioneer variety (8.7 mt/ha), with the lowest straw yield achieved with Anjali variety (0.2 mt/ha). Under SRI methods of SRI cultivation in the midlands, highest straw yield was recorded from Sitasar variety (10.5 mt/ha), and the lowest yield with Sinjenta NK52 variety (0.1 mt/ha). Percent increment in straw yield with SRI over traditional methods ranged from 17 to 357 percent under midland conditions (Fig 20).

Variety-wise number of effective tillers per hill under upland cultivation (traditional vs. SRI)

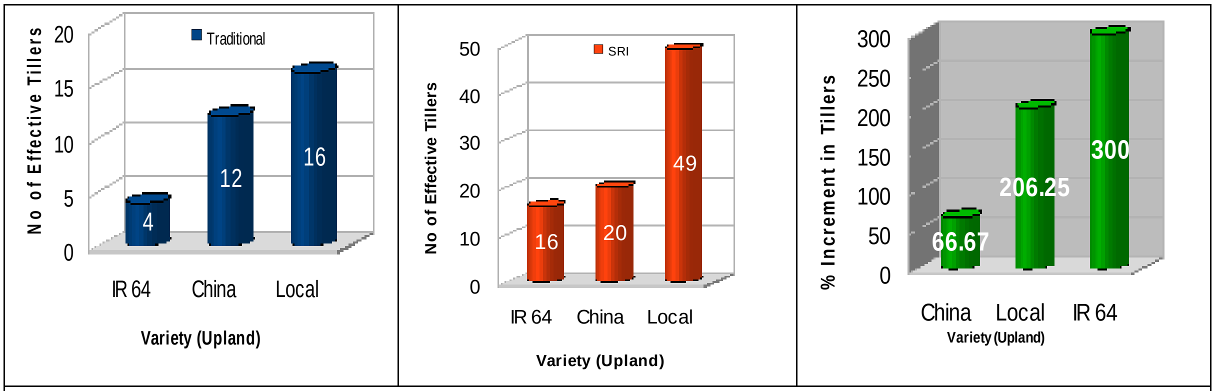

Fig 21. Variety-wise number of effective tillers under upland cultivation (traditional vs. SRI)

As may be evident, under lowland conditions with traditional practices, lowest average number of tillers per hill was observed in the case of IR 64 variety (4) and the highest was observed in the case of Local paddy (16). The analysis of data with respect to SRI cultivation under upland condition indicated lowest average number of tillers with variety IR 64 (16) and highest average number from Local paddy variety (49). Using SRI methods of cultivation, there was an increase in effective tiller production across all varieties ranging from 66 to 300%.

Variety-wise number of grains per panicle under upland cultivation (traditional vs. SRI)

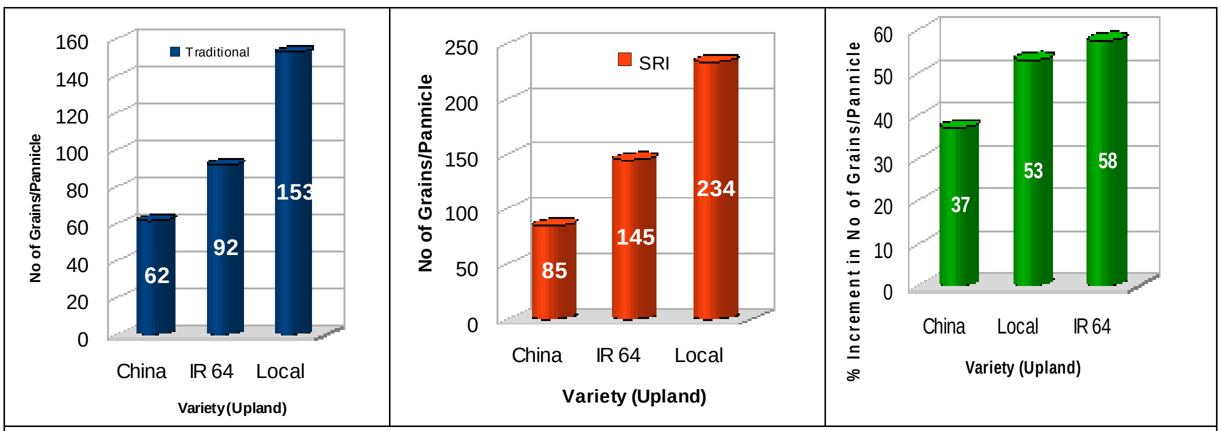

Fig 22. Variety-wise number of grains/panicle under upland cultivation (traditional vs. SRI)

Under upland conditions and using traditional methods, the lowest production of grains/panicle was observed with a variety known as China (62) , while Local paddy variety gave the highest number of grains per panicle (153), while under SRI methods, China produced the lowest number of grains per panicle (85) and Local paddy variety gave the highest number (234). The incremental grains per panicle under SRI management ranged from 37 to 58 percent across all varieties (Fig 22).

Variety-wise straw yield under upland cultivation (traditional vs. SRI)

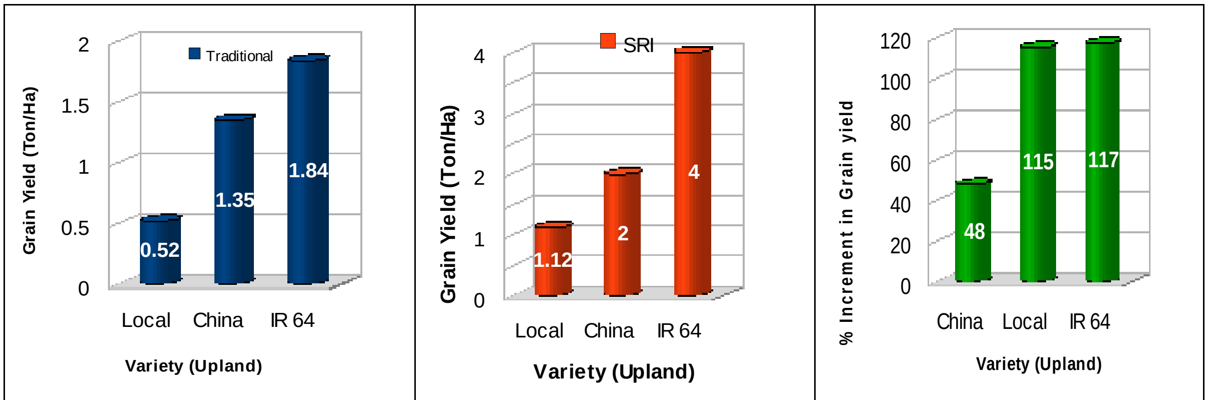

Fig 23. Variety-wise grain yield under upland cultivation (traditional vs. SRI)

It was observed that in the uplands with traditional methods of cultivation, the highest grain yield was recorded with IR 64 variety (1.84 mt/ha), while the lowest grain yield was recorded with Local variety (0.52 mt/ha). Under SRI methods of SRI cultivation, the highest grain yield was recorded with IR 64 variety (4 mt/ha) and the lowest yield with Local variety (1.12 mt/ha). Percent increment in grain yield with SRI cultivation over traditional methods ranged from 48 to 117 percent under upland conditions (Fig 23).

Variety-wise straw yield under upland cultivation (traditional vs. SRI)

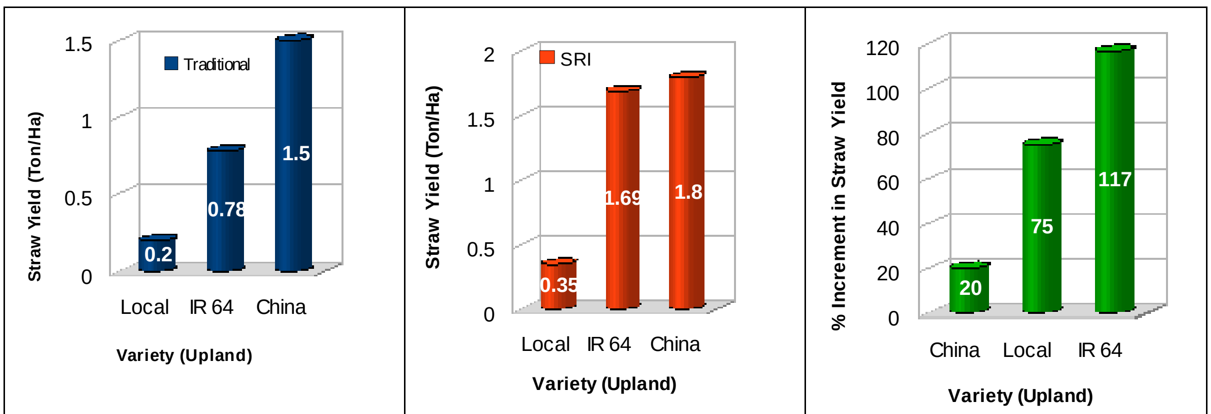

Fig 24. Variety-wise straw yield under upland cultivation (traditional vs. SRI)

It was observed that under upland conditions, the highest straw yield with traditional management was from China variety (1.5 mt/ha), with lowest straw yield from Local variety (0.2 mt/ha). Under SRI methods of cultivation, highest straw yield was recorded from China variety (1.8 mt/ha) and lowest yield from Local variety (0.35 mt/ha). Percent increment in straw yield with SRI over traditional methods ranged from 20 to 117 percent in upland cultivation (Fig 24).

5. Food Security

Food security is the most important aspect of the project intervention. The main objective of the project is to ensure greater food security through increased production of paddy using SRI cultivation methods. The outcome of the project intervention during kharif 2010 in respect of 52 Nodal agencies, working with 5,195 farmers, was analysed to take into account the different landholding sizes and landholding patterns, comparing both traditional and SRI methods of cultivation and assessing impacts on food security. Incremental changes in food security were assessed by following two methods for each landholding size, as discussed

1 Three land holding classes were identified for sorting out yield data as indicated in Table 15. Average comparisons of upland vs. midland vs. lowland conditions were arrived at, using pooled data.
2 For each landholding class, the average projected grain yield was worked out, using the average landholding pattern and multiplying this using average yield data for each landtype. The grain yield for all the landtypes in each size class was added and converted into a food security measure in terms of the number of days when a household had sufficient grain for consumption from its own production, using the formulae: FS = (y x 0.66)/3.8
where FS = projected food security (in days), and y = yield of grain from the total land area. The number 0.66 is a factor that adjusts yield of paddy rice to the resulting amount of milled rice for consumption; 3.8 is the average per-day consumption of rice (in kg) by a family of 5 members. This exercise was done using both traditional and SRI paddy yields, with the difference indicating resulting change in household food security.
3 Incremental food security was further assessed using a second method, wherein the projected food security using SRI methods was compared with the food security reported using past food grain production data of households collected through baseline survey.

Table 15. Food security (in days) with SRI cultivation against traditional and baseline

Land holding (acres)	Days of food security (SRI vs. traditional)			Days of food security (SRI vs. baseline)		
	SRI	Traditional	Additional food security	SRI	Baseline	Additional food security
0-1	217	153	64	217	60	157
1-2	416	268	148	416	90	326
> 2	738	326	412	738	165	573

The results indicate that the objective of meeting food security through SRI methods of cultivation has been addressed to a considerable extent. The incremental food security generated through SRI methods assessed through the respective the methods of calculation indicated substantial increase in either case (Table 15). Incremental food security using the projected production of SRI compared with traditional methods of cultivation ranges from 64 days in the case of the lowest landholding class I (0-1 acre), to 148 days in the case of landholding class II (1-2 acres), and rises to 412 days in case of landholding class III (>2 acres).

Incremental food security with SRI compared household food grain production as per baseline data ranged from 157 days in the case of landholding class I to 339 days in the case of landholding class II, to 573 days in the case of landholding class III. There is considerable difference in the incremental yield data reported by the various agencies. However, in all cases there has been an increase in food availability due to SRI methods of cultivation, with the increment in food security ranging from 217 days to 738 days. Since the target groups for this programme are small and marginal farmers, for whom food security is a major issue, it can be concluded that SRI technology offers an opportunity for enhancing the much-needed food security that this vulnerable rural sector lacks, which presently results in poverty-induced migration from the villages.

Land Holding class (acres)	Upland (acres)	Midland (acres)	Lowland (acres)	Total (acres)
0-1	0.20	0.29	0.30	0.79
1 to 2	0.48	0.48	0.49	1.45
>2	1.07	0.93	0.68	2.68

6. Economics of SRI Paddy Cultivation

Data on the economics of paddy cultivation following both traditional as well as SRI methods were pooled from all partner agencies and were then analysed by landtype. The results indicate across-the-board increase in benefit-cost ratios with SRI as compared to traditional system of cultivation across all landtypes, and also from cultivation under upland, midland and lowland conditions (Table 16). The details of the cost-benefit analysis are indicated in Table 16 & 17.

Table 17 C-B ratio with traditional and SRI methods, by landtypes

Land type	Traditional	SRI
Lowland	1.52	2.97
Midland	1.38	2.70
Upland	1.15	1.51

Table 18. Cost of cultivation (traditional vs. SRI) In upland, midland and lowland

Sr No.	Particulars	Cost of cultivation in midland & lowland (in Rs)		Cost of cultivation in upland (in Rs)	
		Traditional	SRI	Traditional	SRI
1	Inputs	3,120	4,405	2,260	3,405
2	Labour component				
a.	Human labour	6,680	5,600	2,640	3,920
b.	Animal resource	1,500	1,500	900	900
3	Machinery rental	1,200	960	0	210
4	Total expenditure on production (1+2+3)	12,500	12,465	5,800	8,435

Table 19. Cost-Benefit Analysis		Lowland			
Components	Rate/kg	Traditional		SRI	
		Production in kg/acre	Income	Production in kg/acre	Income
Income from Grain (in kg)	10	1,385	13,846	2,652	26,518
Income from Straw (in kg)	3	1,704	5,113	3,502	10,506
Total Income			18,960		37,024
Cost of Cultivation			12,500		12,465
Benefit-Cost Ratio (Total income / total expenditure)			**1.52**		**2.97**
		Midland			
Components					
Income from Grain (in kg)	10	1,182	11,822	2,377	23,765
Income from Straw (in kg)	3	1,830	5,490	3,300	9,899
Total Income			17,312		33,664
Cost of Cultivation			12,500		12,465
Benefit-Cost Ratio (Total income / total expenditure)			**1.38**		**2.70**
		Upland			
Components					
Income from Grain (in kg)	10	502	5,020	960	9,595
Income from Straw (in kg)	3	512	1,656	1,050	3,150
Total Income			6,676		12,745
Cost of Cultivation			5,800		8,435
Benefit-Cost Ratio (Total income / total expenditure)			**1.15**		**1.51**

Conclusions

The programme to address food security through promotion of SRI in Jharkhand has helped in building an atmosphere of positive change. In the face of obstacles like poor and erratic monsoon, the SRI technique has performed exceptionally well. The technique has proved its suitability in terms of lower water requirement and less seed requirement in rainfed areas. Because of the low seed requirement, farmers were able to go for planting in some cases for the third time in response to delayed monsoon.

The major learning from the project is indicative of the fact that the process can be adapted to overcome the drought situation affecting paddy production in the state in recent times. The drought-coping mechanisms that have been observed in the project include a shift toward short- to medium-duration varieties, planting of staggered nurseries, and low seed requirement. The major findings can be summarized as belowL

1. Due to draught-like situations and erratic monsoon, only 53% of the targeted farmers and 57% of the targeted area could be covered during the 1st year under the SRI programme. This may be considered an encouraging outcome considering that overall transplantation of paddy in the state was much less, only 28% of the total paddy-growing area during kharif 2010.
2. Under conditions of poor rainfall, drought-tolerant varieties used with SRI methods have done comparatively well.

3. Number of effective tillers per hill and number of grains per panicle have shown significant increase with SRI methods as compared with the traditional methods of rice cultivation
4. Grain yield with SRI methods showed 194% increase, and straw yield in SRI methods had 189% increase over traditional method.
5. The seed requirement following SRI methods was observed to be 2-2.5 kg/acre of paddy land as against 20-25 kg/acre following traditional cultivation practices, a 90% reduction.
6. Costs of cultivation were observed to have been reduced with SRI while income levels of small and marginal farmers have increased.
7. The B-C ratio of SRI method of cultivation was found to be much higher than that for traditional cultivation practice across all landtypes.
8. Average increments in food security ranged from 64 days in land class I to 412 days in land class III

The major challenge is to reach out to 30,000 farmers in the coming year, for which adequate planning based on the learning of the previous year has already been initiated.

Way forward

Plan for SRI 2011-12

1. All the uncovered farmers will be covered in the current year.
2. PIAs are advised to select areas on the basis of water availabilty and to create water-harvesting structures like farm ponds or 5% model structures in the field to augment the irrigation potential**.**
3. Drought-resistant paddy varieties should be used for the next year of the programme. The resource agencies should contact Central Upland Rice Research Institute (CURRI), Hazaribagh and should help the PIAs and farmers in this matter.
4. Input subsidies on fertiliser and its allocation may be decided by the PIAs based upon the total funds available with them.
5. More number of sensitization programmes are to be rendered for the farmers.
6. Selection of the variety of rice should be based on the last year's experience.
7. In order to promote promotional activities, picture books/leaflets for individual households should be distributed among farmers, also communication materials should incorporate local experience along with technology, plus a compilation of the present year's experience in audio –visual events.
8. The resource agencies are to ensure the availability of seed based on area coverage and agroclimatic conditions.
9. Agencies should be prepared for contingent planning in case of another failure of m0nsoon.
10. A small programme covering 1,000 farmers following System of Wheat Intensification (SWI) has been taken up during *rabi* season 2010-11. This programme along with other crops like mustard may be intensified during 2010-11

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The average yield for India during the year was 2.08 ton/ha, with Tamil Nadu having the highest average yield at 3.2 ton/ha. Yields vary a great deal within Jharkhand due to the undulating topography and varying levels of development of agriculture. Planning Commission, *ibid*.

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Sl No.	List of Project Implementing Agency
1	Professional Assistance for Development Assistance (PRADAN), Godda
2	Professional Assistance for Development Assistance (PRADAN), Bokaro
3	Professional Assistance for Development Assistance (PRADAN), Koderma
4	Professional Assistance for Development Assistance (PRADAN), West Singhbhum
5	Tagore Society for Rural Development, Patamda, East Singhbhum
6	AGRAGATI, Ramgarh
7	Mahila Jagriti Samti, Ranchi
8	Serve Sewa, Hazaribagh
9	Mahila Mandal, Itkhori, Chatra
10	Badlao Founndation, Dumka
11	Jan Jagaran Kendra, Hazaribagh
12	Rural Development Association, Ghatsila, East Singhbhum
13	Gramika India, Giridih
14	Net work for Enterprise Enhancement and Development Support (NEEDS), Deoghar
15	Dridh Sankalap, Jamtara
16	Prabala Samaj Sevi Sansthan, Jamtara
17	Janlok Kalyan Parisad, Pakur
18	Santhal Pargana Antodaya Ashram, Deoghar
19	Chotnagpur Sanskritik Sangh, Ranchi
20	MADAIT, Ranchi
21	Gene Campaign, Ranchi
22	Jan Sahabhagi Kendra, Garhwa
23	SAHIYA, Ranchi
24	Chetna, Ranchi
25	Abhinav Vikas Seva Samiti, Latehar
26	Krishi Gam Vikas Kendra, Latehar
27	Sampurna Gram Vikas Kendra, Palamau
28	Shri Ramkrishna Sarada Math & Mission, Hazaribagh
29	Agrarian Assistance Association, Dumka
30	Foundation For Emancipation of Marginalised, Ranchi
31	Tata Steel Rural Development Society, East Singhbhum
32	Indian Gramin Services, Ranchi
33	Nav Bharat Jagriti Kendra, Hazaribagh
34	SUPPORT
35	PRAVAH, Deoghar
36	Citizen Foundation, Ranchi
37	Bihar Pradesh Yuva Parishad, Palamau
38	Shramjivi Mahila Samiti, East Singhbhum
39	Animation Rural Outreach Service, Gumla
40	Gram Jyoti, Deoghar
41	RACHNA, Deoghar
42	Lokdeep, Deoghar
43	Chetna Vikas, Deoghar
44	Sindurtola, Ranchi
45	Bharatiya Manav Vikas Seva Samiti, Deoghar
46	Lok Prerna,Deoghar
47	Indian Rural Association, Deoghar
48	PIDIT, Deoghar
49	Technology Resource Communication and Service Centre, Jamshedpur, East Singhbhum
50	Maula Azad Samajik Saiskhyanik Kendra (MASSP), Deoghar

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