ISSN (Online): 2091-2609
DOI Prefix: 10.3126/ijasbt

International Journal of Applied Sciences and Biotechnology (IJASBT)

Research Article

Adoption and Maintenance of Self Seed Sufficiency in Major Cereal Crops in Mid-Western Terai of Nepal

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Abstract

Regional Agricultural Research Station Nepalgunj (RARS/N) has its four major outreach sites in Satbariya Village Development Committee (VDC) of Dang, Betahani VDC of Banke, Mahammadpur VDC of Bardiya, Patharaiya VDC of of Kailali and model village in Mainapokhar VDC of Bardiya district for test and verify the acceptance of new released varieties under farmers' field condition and provide an opportunity to the farmers to select most suitable variety on their own choice based on performance. Seed was distributed throughout the OR sites and model village for newly released varieties for self seed sufficiency. New most recent varieties of rice and wheat released in the previous year from concerned commodity research programme, National Rice Research Programme (NRRP), Hardinath and National Whear Research Programme (NWRP), Bhairawaha respectively, were selected. The yield attributing characters, total yield, percentage yield used as seed in the next fiscal year were recorded. Response of the participating farmers for various varieties with respect to various attributes of yield and other important criteria for sustainable cultivation were recorded in individual sheet. Agronomic management practices were done according to recommendation practices for particular crop. Rice varieties of Sukkha series adoption rate was increasing trend. Among them Sukkha Dhan 1, Sukkha Dhan 2 and Sukkha Dhan 3 adoption rate was higher. Wheat variety Gautam adoption rate was higher followed by NL 971.

Keywords: Outreach site; yield; adoption rate

Introduction

An estimated 60 percent of households cannot meet their own food needs, especially in mountainous areas, and agricultural production only meets food requirements for three to eight months per year in Nepal (Action against Hunger, 2006). The food security situation of the country is becoming more challenging due to climate change, political and economical instability. Seed, fertilizer and irrigation are the major inputs to improve production and productivity. Quality seeds of improved and desired varieties are the most important and least expensive agricultural input but its availability and accessibility at right time and location is playing important role to determine the local productivity, production and food security. Presently, there are four different agencies: public sector led (NARC, DOA, NSC

Cite this article as:

R.D. Chaudhary et al. (2018) Int. J. Appl. Sci. Biotechnol. Vol 6(1): 38-44. DOI: 10.3126/ijasbt.v6i1.19467

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Peer reviewed under authority of IJASBT

etc), community led (DISSPRO, CBSP, CSB, Cooperatives), private led (SEAN, Agro vets, Seed Companies) and import led (SEAN, Agro vets, importers and distributors) are involving in seed sector development in Nepal (CDD, 2011a; CDD, 2011b). However, the seed replacement rate (SRR) of major field crops at present in Nepal is very low (about 8%), seed supply is mostly from informal sectors (SQCC, 2011). District Level Seed Self Sufficiency Program (DISSPRO), Community Based Seed Production (CBSP) program, Commercial Seed Production Program and Community Seed Bank are seed initiatives taken by CDD/DoA. District Level Seed Self Sufficiency Program (DISSPRO) and Community Based Seed Production program (CBSP) are the major initiatives started during 9th five-year plan by the government to have local level seed sufficiency of the major cereals in the country (CDD, 2011a). They are claimed to be taking major role on local level improved seed availability over other GO, NGOs or private led agencies at present, and it is needed to be verified. Nepal Agricultural Research Council is responsible for crop breeding, varietal improvement, source seed production and supply. Strengthening seed sector for rapid rise on SRR is necessary for to enhance crop production and food security in Nepal.

RARS, Nepalgunj has its four major outreach sites in Satbariya Village Development Committee (VDC) of Dang, Betahani VDC of Banke, Mahammadpur VDC of Bardiya and Patharaiya VDC of of Kailali district and model village has been established in Mainapokhar VDC of Bardiya district where newly release varieties of rice and wheat were distributed. The sites so mentioned are so selected and established as it would be represent various agro domain conditions of rain feeding, different heights of land for example, up land, low land etc, different type of irrigated conditions as well as different type of wet land (Table 1).

Objectives

- To test the acceptance of new released varieties under farmers' field condition and provide an opportunity to the farmers to select most suitable variety on their own choice based on performance.
- .To disseminate and launch newly released varieties of different cereal crops
- To establish Self Seed Sufficiency for sustainable and profitable farming in Major cereal crops in mid-western region.

Materials and Methods

The Seed sufficiency set was distributed throughout the OR sites and model village (Table-1) for newly released varieties from concerned commodity research programme i.e. National Rice Research Programme (NRRP), Hardinath and National Wheat Research Programme (NWRP), Bhairawaha. The detail of varieties along with number of farmers fields considered, total cultivated area at different sites has been presented in the Table 2. Farmers were oriented to grow the selected varieties besides their local cultivars to compare and verify overall performance of new varieties. The yield attributing characters, total yield, percentage yield used as seed in the next fiscal year were recorded. Response of the participating farmers for various varieties with respect to various attributes of yield and other important criteria for sustainable cultivation were recorded in individual sheet.

Adoption and Maintenance of Self Seed Sufficiency in rice varieties in Ram Dhan, Sukkha Dhan-1 Sukkha Dhan-2, Sukkha Dhan-3, Sukkha Dhan-5, Radha-4, janki and Sambha mansuli sub-1was implemented at OR sites of Kailali, Dang, Bardiya, Banke and Model village of districts during cropping season 2014/15 and 2015/16 to identify the adoption rate of the tested varieties and as well as to maintain the self-seed sufficiency of these varieties in the community Rice was 45 kg/ha and the fertilizers was applied @ 100:30: 30 Kg NPK/ha. Half of nitrogen (N) was top dressed 20-25 DAT (Days after transplanting) and remaining half was applied 2 times at 45-50 DAT and 65-70 DAT. Transplanting method, irrigation and all other agronomical operations we are carried out as per farmer's practices. The attribute of adoptively was define on the yield rate, percentage of total yield used in the seed and associated with the intensity of disease & pests, grain quality, market price and demand, lodging condition, quality and quantity of straw, milling quality, cooking quality & taste. The observations of these variables were taken through the yield data of individual plots, participatory monitoring of trial field and interaction with the participant farmers. Likewise, Self Seed Sufficiency in wheat varieties NL-971, Self Seed Sufficiency in rice varieties in NL-971,Vijay, Aditay, Bhrikuti and gautam in were sown in line @ 120 kg/ha and the fertilizer was applied @ 100:50:25 kg NPK/ha. Seed was sown in 2nd week of November and harvesting was completed by 2nd week of April. Agronomical operations were carried out as per the recommended practices.

Table 1: Description of the outreach sites of Regional Agricultural Research Station (RARS), Khajura, Banke

District	VDC	Geographic Description
Banke	Betahani VDC, Nauragoudhi	Low wet-land and dry land, 180 masl
Bardiya	Joshipur VDC, Mohamadpur	Middle wet-land and dry land, 180 masl
Dang	Satbariya VDC, Satbariya	Irrigated and rain fed, 185 masl
Kailali	Jabalpur VDc Patharyia	Irrigated and rain fed, 115 masl

Table 2: The Summary of participating farmers, varieties, total cultivated area at different sites

Crops	Varieties	No. of participant farmers					Total cultivated area-(Kattha)
		Kailali	Dang	Bardiya-OR	Bardiya-Model village	Banke	
Rice	Ram dhan	3	3	3	12	2	31
	Sukkha Dhan-1	9	9	9	17	5	57
	Sukkha Dhan-2	6	6	6	8	4	38
	Sukkha Dhan-3	6	6	6	8	6	40
	Sukkha Dhan-5	6	-	6	5	6	32
	Radha-4	-	-	-	7	-	7
	Janki	-	-	-	5	-	5
	Sambha mansuli sub-1	-	-	-	2	-	4
Total		30	24	30	64	23	214
Wheat	NL-971	11	5	11	20	11	58
	Vijay	11	10	7	16	7	51
	Aditya	7	5	2	5	2	21
	Bhirkuti	5	5	5	5	5	25
	Gautam	5	5	5	3	5	23
Total		39	30	30	49	30	178

Results and Discussion

Adoption and Maintenance of Self Seed Sufficiency in Rice Varieties in Different Locations of Command Districts

In 2014/15, the highest adoption rate of Ram Dhan was observed in OR site of Banke because cent percent of the yield was used in seed, whereas comparatively lower use in OR sites of Dang, Bardiya and Kailali districts. The amount used in seed in these locations was recorded 80.6 %, 63.2 % and 62 % respectively (Table 3). In average over all locations, 75% of the total yield was used in seed. Total 1240 kg Ram Dhan seed has maintained self-seed sufficiency in the community to replace old seed or variety for total 27 hectare cultivation area.

The adoption rate of Sukkha Dhan-1 was found comparatively lower. The highest 59.5 % of the total yield amount used in seed was recorded in the Kailali OR site and only 28.9, 25.9 and 25.5 percentage was recorded in Dang, Banke and Bardiya districts respectively (Table 3). The low adoption of Sukkha Dhan-1 in this location to was due to good performance of Radha-4 already adopted variety. In average 34.9% of the total yield was used in seed. Total 556 kg Sukkha Dhan-1 used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 12.3 hectare cultivation area.

In 2015/16, the highest adoption rate of Sukkha Dhan 1 was observed in OR site of Bardiya because it produced more grain and straw yield than farmer old variety and 64.8% of total produced was used for seed, whereas comparatively lower use in OR sites of Dang, Banke and Kailali districts. The amount used in seed in these locations was recorded 43.9 %, 43.4 % and 40.2 % respectively. In average over all locations, 47.2 % of the total yield was used in seed (Table 4). Total 2430 kg Sukkha Dhan 1 seed has maintained self-seed sufficiency in the community to replace old seed or variety for total 54 hectare cultivation area.

Likewise, the highest adoption rate of Sukkha Dhan 2 observed 70.9 % of the total yield amount used in seed was recorded in the Bardiya OR site followed by 57.1 %, 53.8 % and 40.4 % was recorded in Banke, Kailali and Dang districts respectively(Table 4). In average 53.3 % of the total yield was used in seed. Total 2610 kg Sukkha Dhan-2 used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 58 hectare cultivation area.

Similarly, the highest adoption rate of Sukkha Dhan 3 observed 57.6 % of the total yield amount used in seed was recorded in the Bardiya OR site followed by 56.3 %, 49.8 % and 39.6 % was recorded in Kailali, Banke and Dang districts respectively (Table 4). In average 50.0 % of the total yield was used in seed. Total 2650 kg Sukkha Dhan-3 used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 58.8 hectare cultivation area.

The adoption rate of Sukkha Dhan-5 was found comparatively lower. The highest 34.6 % of the total yield amount used in seed was recorded in the Banke OR site followed by 34.4 % and 29.3% was recorded in Banke and Kailali districts respectively (Table 4). The low adoption of Sukkha Dhan-5 in this location to was due to good performance of Radha-4 already adopted variety. In average 32.8% of the total yield was used in seed. Total 1275 kg Sukkha Dhan 5 used in seed has maintained self seed sufficiency in the community to replace old seed or variety for total 28.4 hectare cultivation area.

Table 3: Adoption rate of major rice varieties in OR sites of RARS/N during 2014/15

OR Site	RamDhan			Sukkha Dhan-1		
	Total Yield (kg)	used for seed (kg)	% in use seed	Total Yield (kg)	used for seed (kg)	% in use seed
Kailali	468	290	62.0	346	206	59.5
Dang	372	300	80.6	294	85	28.9
Bardiya	435	275	63.2	490	125	25.5
Banke	375	375	100.0	540	140	25.9
Total	1650	1240	75.0%	1670	556	34.9

Table 4: Adoption rate of major rice varieties in OR sites of RARS/N during 2015/16

OR Site	SukKha Dhan -1			SukKha Dhan -2			SukKha Dhan -3			SukKha Dhan -5		
	Total Yield(kg)	used for seed (kg)	% in use seed	Total Yield (kg)	used for seed (kg)	% in use seed	Total Yield (kg)	used for seed (kg)	% in use seed	Total Yield (kg)	used for seed (kg)	% in use seed
Kailali	1316	530	40.2	1171	630	53.8	1206	680	56.3	1294	380	29.3
Dang	1365	600	43.9	1780	720	40.4	1690	670	39.6	-	-	-
Bardiya	1080	700	64.8	1100	780	70.9	1300	750	57.6	1365	470	34.4
Banke	1380	600	43.4	840	480	57.1	1103	550	49.8	1225	425	34.6
Total	5141	2430	47.2	4891	2610	53.3	5299	2650	50.0	3884	1275	32.8

In district wise observation, Sukkha Dhan 2 adoption rate high followed by Sukkha Dhan 1 and Sukkha Dhan 3 in Bardiya. Likewise, Sukkha Dhan 3 adoption rate was higher followed by Sukkha Dhan 2 and Sukkha Dhan 1 in Kailali and Sukkha Dhan 1 adoption rate was higher followed by Sukkha Dhan 2 and Sukkha Dhan 1 in Dang and Sukkha Dhan 2 adoption rate was higher followed by Sukkha Dhan 3 and Sukkha Dhan 1.

Adoption and Maintenance of Self-Seed Sufficiency Wheat Varieties in Different Location of Command Districts

In 2014/15, the highest adoption rate of Aditya was observed in OR site of Dang because it produced more grain yield than farmer old variety and 85.5% of total produced was used for seed followed by OR sites of Banke, Bardiya and Kailali districts. The amount used in seed in these locations was recorded 81.3 %, 57.8 % and 22.0 % respectively (Table 5). In average over all locations, 54.0 % of the total yield was used in seed. Total 873 kg Aditya seed has maintained self-seed sufficiency in the community to replace old seed or variety for total 7.2 hectare cultivation area.

Likewise, the highest adoption rate of NL 971 observed 59.4 % of the total yield amount used in seed was recorded in the Banke OR site followed by 57.1 % and 23.7 % was recorded in Bardiya and Kailali districts respectively (Table 5). In average 47.1 % of the total yield was used in seed. Total 910 kg NL 971 used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 7.6 hectare cultivation area.

Similarly, the highest adoption rate of Vijaya observed 82.1 % of the total yield amount used in seed was recorded in the Bankea OR site followed by 49.1 %, 35.9 % and 20.6 % was recorded in Kailali, Bardiya and Dang districts respectively (Table 5). In average 44.0 % of the total yield was used in seed. Total 675 kg Vijaya used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 5.3 hectare cultivation area.

In district wise observation, Vijay adoption rate high followed by NL 971 and Aditya in Kailai. Likewise, Aditya adoption rate higher followed by Vijaya in Dang. Similarly, Aditya adoption rate higher followed by NL 971 and Vijay in Bardiya and Vijay adoption rate high followed by Aditya and NL 971.

In 2015/16, the highest adoption rate of Gautam was observed in OR site of Bardiya because it produced more grain and straw yield than farmer old variety and 80.2 % of total produced was used for seed, whereas comparatively lower use in OR sites of Banke, Kailali and Dang districts. The amount used in seed in these locations was recorded 68 %, 63.3 % and 59.8 % respectively (table 6). In average over all locations, 68.1 % of the total yield was used in seed. Total 1140 kg Gautam seed has maintained self-seed sufficiency in the community to replace old seed or variety for total 9.5 hectare cultivation area.

Table 5: Adoption rate of major Wheat varieties in OR sites of RARS/N during 2014/15

OR Site	NL-971			Aditya			Vijay		
	Total Yield(kg)	used for seed(kg)	% in use seed	Total Yield (kg)	used for seed(kg)	% in use seed	Total Yield(kg)	used for seed(kg)	% in use seed
Kailali	532	150	23.7	379	150	22.0	529	260	49.1
Dang	-	-	-	425	365	35.8	485	100	20.6
Bardiya	560	320	57.1	242	140	57.8	237	85	35.9
Banke	740	440	59.4	268	218	31.3	280	230	32.1
Total	1932	910	47.1	1614	873	54.0	1531	675	44.0

Likewise, the highest adoption rate of NL 971 observed 81.5 % of the total yield amount used in seed was recorded in the Bardiya OR site followed by 73.3 %, 41.1 % and 40.0 % was recorded in Banke, Kailali and Dang districts respectively. In average 53.3 % of the total yield was used in seed. Total 1010 kg NL 971 used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 8.4 hectare cultivation area.

Similarly, the highest adoption rate of Sukkha Dhan 3 observed 77.9 % of the total yield amount used in seed of Vajaya was recorded in the Bardiya OR site followed by 53.4 %, 43.3 % and 41.1 % was recorded in Kailali, Banke and Dang districts respectively. In average 53.5 % of the total yield was used in seed. Total 940 kg vijaya used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 7.8 hectare cultivation area.

The adoption rate of Bhrikuti was found comparatively lower. The highest 55.3 % of the total yield amount used in seed was recorded in the Dang OR site followed by 55.2 %, 54.3 and 31.4 % was recorded in Bardiya, Kailali and Banke districts respectively. In average 47.7 % of the total yield was used in seed. Total 690 kg Bhrikuti used in seed has maintained self seed sufficiency in the community to replace old seed or variety for total 5.75 hectare cultivation area.

In district wise observation, Gautam adoption rate high followed by Vijay and Bhrikuti in Kailai. Likewise, Gautam adoption rate was higher followed by Bhrikuti in Dang. Similarly, NL 971 adoption rate higher followed by Gautam and Vijay in Bardiya and NL 971 adoption rate high followed by Gautam and Vijay.

Adoption and Maintenance of Self Seed Sufficiency in Rice Varieties in Model Village

Pooled data showed that high yield variation was observed between the tested varieties. The highest yield 4812 kg/ha was recorded in Sukkha Dhan 2 and comparatively lower yield 3445 kg/ha was recorded in Janaki. The farmers preferred most Radha-4 as well as Sukkha Dhan-3 due to good yield, drought tolerant, early maturity and good market price because these varieties have provided food and as well as fodder to their animals even in crises period occurred after rainy season.

Radha 4 adoption rate was higher (82.9 %) followed by Sukkha Dhan 3 (44.2) (Table 7). Other varieties productivity good but adoption was low due less awareness to farmers and business man. Farmer said marketing of new varieties was difficult because businessman refuse to buy new varieties and price also low. Adoption rate of low water requiring varieties (Sukkha series and Radh 4) was high in this place because most of cultivated land was rainfed. Whereas more water requiring varieties (Ram Dhan, Janaki and Samba Masuli Sub 1) adoption rate low i.e. less than twenty percent because irrigation form boring during grain formation stage costly and water becoming limited. In average 31.7 % of the total yield was used in seed. Total 4910 kg (1110 kg Sukkha Dhan 3, 1000 kg Radha 4, 920 kg Sukkha Dhan 1, 670 kg Sukkha Dhan 2, 525 kg Ram Dhan, 400 kg Sukkha Dhan 5, 190 kg Janaki and 95 kg Samba Mansuli Sub 1) used in seed has maintained self-seed sufficiency in the community to replace old seed or variety for total 109.1 hectare cultivation area.

Table 6: Adoption rate of major Wheat varieties in OR sites of RARS/N during 2015/16

OR Site	NL – 971			Vijay			Bhirkuti			Gautam		
	Total Yield (kg)	used for seed(kg)	% in use seed	Total Yield (kg)	used for seed(kg)	% in use seed	Total Yield (kg)	used for seed(kg)	% in use seed	Total Yield (kg)	used for seed(kg)	% in use seed
Kailali	535	220	41.1	430	230	53.4	331	180	54.3	221	140	63.3
Dang	400	160	40.0	389	160	41.1	325	180	55.3	501	300	59.8
Bardiya	368	300	81.5	385	300	77.9	344	190	55.2	436	350	80.2
Banke	450	330	73.3	577	250	43.3	445	140	31.4	514	350	68.0
Total	1753	1010	57.6	1754	940	53.5	1445	690	47.7	1672	1140	68.1

Table 7: Yield performance and adoption rate of different rice variety in Model Village Mainapokhar of Bardiya district during 2014/15 and 2015/16

Varieties	No. of participants	Total cultivated area-(Kattha)	Total Yield (kg)	Yield (kg/ha)	Used in seed (kg)		
					Own farm	Sold to others	Total Yield (%)
RamDhan	12	20	2703	3710	210	315	19.2
Sukkha Dhan-1	17	25	3726	3725	370	550	24.6
Radha-4	7	7	1205	4000	225	775	82.9
Janaki	5	5	1021	3445	60	130	18.6
Sukhkha Dhan-2	8	16	2575	4812	250	420	26.0
Sukhkha Dhan-3	8	16	2510	4706	480	630	44.2
Sukhkha Dhan-5	7	17	1963	4206	220	180	20.3
Sambha mansuli sub-1	2	4	530	3975	45	50	17.9
Total	66	110	16233		1860	3050	31.7

Table 8: Yield performance and adoption rate of different wheat variety in Model Village Mainapokhar of Bardiya disrtict in year (2014/15 and 2015/16)

Varieties	No. of participants	Total cultivated area- (Kattha)	Total Yield (kg)	Yield (kg/ha)	Used in seed (kg)		
					Own farm	Sold to others	Total Yield (%)
NL 971	20	24	2725	2430	700	1005	62.5
Vijay	16	16	1655	2890	595	445	62.8
Aditya	5	5	520	2850	30	105	25.9
Bhirkuti	5	5	487	2922	180	150	67.7
Gautam	3	3	330	3300	180	150	100
Total	49	53	5717		1685	1855	63.7

Adoption and Maintenance of Self Seed Sufficiency in Wheat Varieties in Model Village

From two years pooled data, the highest adoption rate of Gautam observed 100 % of the total yield amount used in seed was recorded followed by 67.7 %, 62.8 %, 62.5 % and 25. 9 % was recorded in Bhrikuti, Vijaya, NL 971 and Aditya respectively. In average 63.7 % of the total yield was used in seed. Total 3540 kg (1705 kg NL 971, 1040 kg Vijaya, 330 kg Gautam, 330 kg Bhrikuti and 135 kg Aditya) used in seed has maintained self -seed sufficiency in the community to replace old seed or variety for total 29.5 hectare cultivation area. Detail result is presented in table 8.

Conclusion

Rice varieties of Sukkha series adoption rate was increasing trend. Among them Sukkha Dhan 1, Sukkha Dhan 2 and Sukkha Dhan 3 adoption rate was higher in OR Sites due to high yielding and drought tolerance nature. In Model village, Radha 4 adoption rate was high followed by Sukkha Dhan 3. Likewise, wheat variety Gautam adoption rate was higher followed by NL 971 in OR sites and Model village.

Acknowledgement

The authors wish to express their appreciation to farmers who providing experimental plots and voluntary participation during the course of experiment and data recording. Likewise, express our gratitude to recorders of outreach sites, all activity leaders, site in-charge and support staff of this station for their tremendous help and support to carry out this study.

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