

## Effects of cultivation methods on yield of local rice varieties in Kunduz, Afghanistan

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### Abstract

I did my research about Effect of Cultivation Methods on Yield of Local Rice Varieties in Kunduz province from March to October 2016. The treatments comprised of three Local Verities released high yielding and common varieties in Northeastern zone viz., BARA, LUK and SURKHA- ZERAATI and three cultivation methods like., SRI (System of Rice intensification), RIPA (Rice Improvement Program for Afghanistan) and Traditional method by transplanting under research program of the Agriculture Faculty of Kunduz University with HEDP support. It was a factorial experiments (Split Plot Design) conducted in a Randomized Complete Block Design with four replications. Planting methods had a significant effect on the yielding of varieties per unit of area. The rice crop established with transplanting on three above methods.

The variety of BARA in RIPA method gave the highest yield (3.42 t-ha<sup>-1</sup>) when compared to other varieties, rice of BARA is the best variety which has good quality and had highest yield among of varieties. As, LUK in SRI system, and variety of SURKHA-ZERAATI in traditional had good preformed.

Here is many other Effects of interaction of varieties and cultivation methods on the yield viz., rice of BARA in RIPA method, variety of SURKHA-ZERAATI in traditional method and LUK variety had more products on SRI method. Therefore, the highest variable cost was incurred by the RIPA method (56894.00 BDT ha<sup>-1</sup>) while the lowest variable cost was incurred by the SRI method (31000.00 BDT ha<sup>-1</sup>). But, SRI method cost benefit is more than other methods.

**Keywords:** RIPA, SRI, traditional, LUK, BARA, SURKHA- ZERAATI, rice

### 1. Introduction

Rice is the seed of the grass species *Oryza sativa* (Asian rice) or *Oryza glaberrima* (African rice) (Sarhadi *et al.*, 2008) [12]. As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population (2.4 milliard people) (Lampa. 1995) [8]. It is the agricultural commodity with the third highest worldwide production, after sugarcane and maize. Since a large portion of maize crops are grown for purposes other than human consumption, rice is the most important grain with regard to human nutrition and caloric intake, providing more than one fifth of the calories consumed worldwide by human (Khudabanda, 1387) [3]. According cultivated land, rice is the second largest cereal crop in Afghanistan and the main source of calories for people after wheat (Fazludin *et al.*, 1386) [6].

After wheat rice is the most important staple crop in Afghanistan and most of the rice grown in the Northeastern provinces, including Baghlan, Kunduz, Takhar, Laghman, Nangarhar, Balkh and Kunarha. but, rice is mainly cultivated in the Kunduz river basin within the much larger Amu Darya river basin that crosses international boundaries (Ali Mohamad Ramzi *et al.*, 2013) [9].

The level rice production in 2011 -2012, around 210000 hectare of rice were planted with total amount of production of 449400 ton the average yield was 2.14 t/ha, the rice production is not sufficient to meet food necessary of people due to low yielding capacity of fields and lack of basic research (Santibanez el *et al.*, 2012) [11].

At present, rice cultivation is done in different ways in the world. The most important cultivation ways are direct seeding and transplanting methods (Hamidullah., 1388) [2]. To solve the problem of the labor shortage, alternate methods of rice

stand establishment are inevitable. direct seeding of rice is a potential directly seeded crops are faster and easier to plant, less labor intensive and consume less water (W. A. Jahangir *et al.*, 2005) [15].

SRI method has received much attention all over the word by the agronomist because of its low-input demand. Therefore, the last study was designed evaluate, Rice Production under Water Management Constraints with SRI Methods in Northeastern Afghanistan which is a successful method in various rice growing, the final rice cultivation system in Afghanistan as other countries is affected by the water deficiency, the low suitable land, and shortages of worker. Thus, SRI system can save the water deficiency, least labor and technique of cultivation (Ali Muhammad *et al.*, 2009) [4].

Rice cultivation in Afghanistan is predominantly practiced, involves seed broadcast and transplanting of seedlings, for solving problem, find out the best method of cultivation and use the best local varieties. In this study, local varieties of rice are considered to use in three methods of cultivation (SRI, RIPA and traditional method) to find out which variety in which method has the best performance, the result showed among of three local rice varieties and three cultivation methods are considered. We had founded which SRI method is better than other. Because this method need to less water, using seed rate at least amount, using chemical and manure at least. The varieties of aroma like BARA has good quality, good market and good adaptation in Kunduz climate (Sarhadi *et al.*, 2008) [12].

### 2. Material and Methods

The experiment was conducted at the Kunduz University, Faculty of Agricultural and it's located in Northeast of

Afghanistan. The Kunduz elevation is 404m (68.6°52.5'E longitude and 36.22°58.12'N latitude). From March to October 2016 to find out the Effect of Cultivation Methods on Yield of Local Rice Varieties in Kunduz. Soil of the experimental field belongs to the Terrace Soils. The region belongs to Warm temperate. The experiential soil characters are shown in Table -1. The treatments comprised of three local varieties SURKHA ZERAATI, BARA and LUK with three planting methods like; SRI, RIPA and Traditional. It was a Split plot design conducted in a Randomized Complete Block Design with four replications. Layout of the experiment was done on 3 June 2016 with inter plot spacing of 1.0m and inter block spacing of 1.0 m. there were 16 main plots and 36 sub -plots, The size of each unit plot was 5.0 m × 5.3m and the size of each sub plot was 5.0 m × 1.5m. The amount of seed sowing on nursery bed at 5 kg. ha<sup>-1</sup> in SRI, 50 kg.ha<sup>-1</sup> in RIPA and 125 kg.hac<sup>-1</sup> in traditional method. It was done in RIPA and traditional on 22 April 2016 and in SRI on 19 May2016.

In SRI method we had worked the following acts: first 5 kg-ha<sup>-1</sup> from each variety selected and soaking, for nursery bed prepared 4.8 m<sup>2</sup> area and 20 cm height mixing soil with animal manure, after flatting the surface of seed bed, for soil moistening spraying water and seed sowing on nursery bed had done on 19 may 2016. The surface of sowing area was covered by rice straw for keeping soil moisture. In main field of SRI method prepared and transplanted one seedling/ hole on 5 June, the space between rows and plant was 25cm. Other agricultural activities are the same of other system only irrigation system was differ because this system did not efficient to keep water like another systems. Chemical manure three time applied, first phase applied DAP and urea in the time of prepare main field. After 30 days of transplanting second applied just urea, the last phase of applied urea was before of panicle initiation. The field was fertilized with Urea, DAP 105and 70 kg-ha<sup>-1</sup>, respectively. The experiment was conducted in rainfed condition and supplemental irrigation was applied as per necessary.

In RIPA method 25.82 kg/ha seed selected, after soaking and washing seed, 2 days which was wet than broadcast on nursery bed on 24 April 2016. The main field of RIPA method prepared and transplanted 3-5seedling / hole on 5 June, the space between rows and plants were 30 × 15cm. Therefore, all agricultural activities are same to other system, only irrigation system was differ because in this system keeping water in 2<sup>inch</sup> on soil surface for more time. Chemical manure three time applied, first phase applied DAP and Urea in the time of prepared main field. After 30 days of transplanting second applied just urea, the last phase of applied just urea was before of spiking. the field was fertilized with Urea, DAP 105 and 70

kg-ha<sup>-1</sup>, respectively.

The experiment was conducted in traditional method according interview and different references there is no specific space between rows and holes, also the number of plants/hole is random, but we considered same plot and sub-plot 6 -12 plants/hole, 125.82kg-ha<sup>-1</sup>,seed selected. This method had implemented through a questionnaire from 30 farmers of 4 districts (Ali Abad, Khan Abad, Imam Sahib and Dasht- e-Arche). Similarly other factors agricultural practice like; tillage, fertilizer, weeding, are also same other methods. Harvesting was done 15 October 2016 depending upon the maturity of the three varieties on each cultivation method was same. The harvested rice was then dried, threshed and cleaned and necessary data were collected. The collected data were compiled and tabulated for statistical analysis. Data were analyzed statistically for analysis of variance (ANOVA) following (table-3).

### 3. Results and Discussion

#### 3.1 Plant Height

In this study, result showed the height of plant was significant in different cultivars and cultivation methods (Table-2). The maximum measured of effective height plant-1form three varieties viz., BARA (72.93cm) in RIPA, Surkha Zeraati (61.23cm) in traditional and LUK (42.71cm) in SRI methods (Table - 3). Therefore, plant height variety of Luk in SRI method was short. But, Bara variety in RIPA method had more height than others. The result of research done by (Gul Aqa, 2016) showed who the density, plant spacing and number of tillers had effects on plant height.

#### 3.2 Tiller Production

In this study, result showed that the number of effective tillers at harvest was non-significant in different cultivars and cultivation methods (Table 2).The maximum number of effective tillers m<sup>-2</sup> form three varieties viz., Surkha Zeraati (335.25), BARA (267.25) in traditional method and LUK (256) in RIPA method. (Table -3). This might be due to the closer spacing of transplanting in traditional method which increased number of plants m<sup>-2</sup>. But, result of (Ali Muhammad *et al.* 2009) <sup>[4]</sup> showed the maximum number of effective tillers m<sup>-2</sup> in SRI method is more than the other methods.

**Table 1:** Soil characters of the experimental site.

Soil Texture	Organic Matter	Sand (%)	Silt (%)	Clay (%)	PH
Loamy	0.8	36	46	18	8

**Table 2:** Effect of variety on Yield of Local Rice Varieties in Kunduz.

Variety	plant height	Effective tillers m <sup>-2</sup>	Number of grains panicle <sup>-1</sup>	1000 - grains weight (g)	Grains yield (t. ha <sup>-1</sup> )
BARA	67.14	197.58	176	25.425	2.24
LUK	54.19	193.83	182.67	23.9	0.38
SURKHA ZERAATI	57.80	205.92	184.92	24.16	0.76
CV %	11.74	42.04	10.73	5.91	8.27

Values of a column followed by same letter are statistically similar at 5% probability.

**Table 3:** Effect of interaction of variety and cultivation methods on yield of Local Rice Varieties in Kunduz.

Interaction (Variety × Cultivation method)	plant height	Effective tillers m <sup>-2</sup>	Number of grains panicle <sup>-1</sup>	1000- gain weight (g)	Grain yield (t. ha <sup>-1</sup> )
BARA × SRI	58.19	129.75	167.75	24.77	0.64
BARA × RIPA	72.93	195.75	180.5	25.72	3.42
BARA × Traditional	70.30	267.25	179.75	25.77	2.62
LUK × SRI	42.71	110	195.5	27.02	0.68
LUK × RIPA	60.04	256.5	186.75	22.57	0.2
LUK × Traditional	59.80	215	165.75	22.1	0.22
SURKHA ZERAATI × SRI	51.94	122	182.5	25.87	0.36
SURKHA ZERAATI × RIPA	60.24	160.5	178	22.825	0.22
SURKHA ZERAATI × Traditional	61.23	335.25	194.25	23.8	1.74
CV %	11.73	42.04	10.73	5.91	8.27

Values of a column followed by same letter are statistically similar at 5% probability

### 3.3 Number of Grains Panicle

Investigation of grain number panicle<sup>-1</sup> revealed that there was non-significant difference between all forms of planting methods (Table - 4). The variety of Luk in SRI method of seed produce the highest number of total grains panicle-1(195.5) and the lowest number of grains panicle-1(165.75) was recorded from the traditional method for the variety LUK. This might be attributed to better root development in SRI system which produced healthy panicles with higher number of grains (Ali Muhammad *et al.*, 2009) [4] found higher number of grains in SRI system compared to that traditional method.

### 3.4 Thousand Grain Weight

The thousand grain weight was significantly affected by various planting methods. However, the thousand grain weight attained by the crop established through LUK and Surka Zeraati varieties in SRI method and they had highest that followed by transplanting. The lowest grain weight was from Luk variety in traditional method (Table-4), Awan *et al.*, 2007)

reported farm management and planting methods had effects on rice grain weight.

### 3.5 Grain Yield

There was significant difference in producing grain yield (Table -4). RIPA method produced higher grain yield as compared to all other methods. The highest grain yield (3.42 t·ha<sup>-1</sup> for BARA) was recorded from Transplanting (Table 3). Salah Mohammad *et al.*, 1389) [7] reported that many issues has effects on grains yield. Thus, density and spacing of transplanting in each method had role on yielding capacity.

### 3.6 Economic Analysis

The Variable cost varied due to the variation of crop establishment methods (Table -5). The highest variable cost was incurred by the RIPA method (56894.00 BDT ha<sup>-1</sup>) while the lowest variable cost was incurred by the SRI method (31000.00 BDT ha<sup>-1</sup>). This was similar to the results of (Ali Muhammad *et al.*, 2009) [4], who found lowest variable cost in SRI method.

**Table 4:** Effect of cultivated Methods on the Yield of Local Rice Varieties in Kunduz

Cultivate method	plant height	Effective tillers m <sup>-2</sup>	Number of grains panicle <sup>-1</sup>	1000 – grain weight (g)	Grain yield (t. ha <sup>-1</sup> )
SRI method	50.95	120.58	181.92	25.89	0.56
RIPA method	64.40	204.25	181.75	23.70	1.28
Traditional method	63.78	272.5	179.92	23.89	1.54
CV %	11.73	42.04	10.73	5.91	8.27

Values of a column followed by same letter are statistically similar at 5% probability

**Table 5:** Total variable cost of rice under different cultivation methods.

Cultivation Method	Land preparation (BDT ha-1)	Irrigation (BDT ha-1)	Seed (BDT ha-1)	Fertilizer (BDT ha-1)	Labor (BDT ha-1)	Weeding (BDT ha-1)	Total (BDT ha-1)
SRI	3000	1000	500	4000	21500	1000	31000
Traditional	3500	2000	1200	5894	32400	1000	45994
RIPA	4000	3000	1000	5894	42000	1000	56894

The highest cost benefit ratio in SRI method may be due to good result, saving of irrigation water for nursery bed and main field, seed cost and labor charges, duration of nursery, easy carrying seedling and transplanting in the field. (Ali Muhammad *et al.*, 2009) [4]. had found higher net return in his experiment due to saving of labor cost, seed amount cost and irrigation water in SRI method

## 4. Conclusion

It can be concluded from the results that variety of BARA performed better than other varieties when grown with RIPA method, SURKHA ZERATI in traditional and LUK performance SRI system. Therefore, the cultivation of BARA with transplanting in RIPA method, SURKHA ZERATI in traditional method and LUK in SRI system are recommended for better yield.

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