Journal of Rice Science

Case Report

ISSN: 2690-5183 | Volume 1

Varietal Demonstration of Promising Rice Varieties Adaptability and Adoption of Producers

Sanyang SE[1*] and Saidyleigh L[2]

[1]Department of Agriculture, under the Ministry of Agriculture, Cape point Bakau, Kanifing Municipal Council, Gambia

[2]Regional Agricultural Directorate under the Department of Agriculture, Central River Region South

***Corresponding author:**

Saikou E. Sanyang,
Department of Agriculture, under the Ministry of Agriculture, Cape point Bakau, Kanifing Municipal Council, Gambia,
E-mail-Saikoue@mail.com

Received: 08 Oct 2022
Accepted: 17 Oct 2022
Published: 21 Oct 2022

Citation:

Sanyang SE, Varietal Demonstration of Promising Rice Varieties Adaptability and Adoption of Producers. J Rice Sci. 2022; 1(5): 1-5

Keywords:

Demonstration; Variety; Rice; Adoption; Producers and adaptability

1. Abstract

In adequate seed quality has been one of the major constraints to rice production in the Gambia for many decades. A community-based seed multiplication system, implemented in two rice growing regions to improve on production and productivity of different rice traits. There were numerous challenges faced by the rice growers among them is low quality seeds and inadequate knowledge on rice agronomy reducing the yield potentials. The objective of this study is to evaluate the agronomic performance and adaptation of cultivars of rice on multi-location trial in farmers' fields as demonstration plot. The demonstration was conducted in Jahally, Pacharr and irrigated perimeters in Central River Region of the Gambia. The sampling method was purposive sampling with a sample size of six (6) farmers were selected. The data analysis and interpretation was done using the Statistical Package for Social Sciences software (SPSS). The results indicate that, on average Sahel 177 registered the highest yield of 6,793kg while the lowest yield registered was Orylux 6 with 5,940 kg respectively. The research findings revealed that, there was no significant difference in terms of tillers/stand of 42, 44 and 46 on average. In conclusion, the number of tillers may not necessarily have determined the yield but the size and weight of the grain count. Therefore, recommending the government to design policies and create enabling environment that would encourage public-private participation in order to bridge the yield gap potentials

2. Introduction

The main staple food of the population is rice and predominantly grown by women in the low and up-land agro-ecologies shifting from subsistence farming to commercialization of agriculture. The idea of rice crop is being regarded as a woman's crop as it is cultivated mainly by women but over the years' men have shown interest in producing rice. Rice (Oryza sativa and O. glaberrima) increasingly important staple food in the Gambia, however yields are generally declining over the years. The current estimated average yields ranges from 1.1 t ha−1 under rain-fed upland conditions to 2.5 t ha−1 under irrigated conditions while potential yields for irrigated lowland rice range from 10 to 11 tons' ha−1, with rice yield gaps ranging from 30 to 90% (Deng et al.2019). The Gambia is among the countries with huge difference between potential and actual yields. For several decades, from 1970s to 1980s in the Gambia tremendous efforts have been made by Chinese scientists in rice breeding to improve grain yield, nutritional quality and environmental performance, thereby achieving substantial progress in global food security (Zeng,2018). The smallholder farmers encountering low yield potentials are often stuck in a vicious cycle of poverty. Basically, the rice grown is mainly for family consumption and sale at the local markets to earn income for the day-to-day management of the households (Sow et al.2015). The sub-optimal rice productivity is caused by a myriad of production constraints and sub-optimal crop management. The current rice production constraints of smallholder farmers in The Gambia include inadequate ploughing facilities, use of low-yielding varieties, post-harvest losses and in adequate knowledge on rice agronomy (Alfred et al.2021) The cultivation of rice production is either broadcasting method or transplanting method, recently the extension workers

are encouraging the rice producers to do row seeding. Furthermore, system rice intensification is another method of rice cultivation using a seedling per hill or stand and this method of rice production enhances tillering in responding to photosynthesis process for better yields (Gupta and Ladha, 2016. However, smallholder farmers do not have adequate knowledge and skills to carry on field operations such as land levelling, water management, fertilizer application and weeding on timely basis as this affects yield. Most of the country's economy depends on the agricultural sector. For sustainable development, the increase in crop production and supply has increased exponentially (Ismail and Malik,2022). The rice sub-sector is becoming one of the most dynamic agricultural activities in the rural communities of the Gambia. The introduction of improved varieties such as Orylux 6, Sahel 134 and Sahel 177 and increase in cultivable land area would enhance yield to attain food security (FAO 2016). There is window of opportunities for smallholder farmers to increase their food security and income through sales of locally improved rice varieties that have comparative advantage of competing with imported rice. The provision of insufficient quality seeds and other related factors have been major constraints to rice production in Sub-Saharan Africa (Bai et al. 2018). This problem is aggravated by climate change, poor quality seeds and marginal soils which has spillover effects of production and productivity of rice. Sustainable rice production is largely dependent on environment that will encourage private sector involvement in rice production and distribution through the value addition processes. Importantly, rice and other crops on farm land do compete with micro-organisms and weeds not only for water, light, nutrients and space essential for plant growth but equally create problem during harvesting, drying and cleaning (Shrivasta and Kumar, 2015) Weeds also reduce the quality and marketing value of the crop serving as a host to insects, increase production cost, blocking irrigation and drainage canals (Qian et al. 2016). The process of selecting rice varieties with wide adaptability over diverse farming environments is important prior to high rate of varietal adoption. In order to achieve this multi-locational demonstrations, plots were conducted in farmers' fields consisting of only few varieties to further test rice varietal adaptability. Importantly, high yielding rice varieties were received by Rice Value Chain Transformation Project from Africa Rice which were screened and evaluated for their high yield performance and tolerance to the biotic and abiotic stresses in different rice agro-ecologies. These are Orylux 6, Sahel 134 and Sahel 177. These were selected due to the distinguish traits they possessed as high yielding, early maturing, aromatic and submergence tolerant. Rice productivity is influenced by many factors such as land quality and availability of superior rice varieties. Agricultural land and plant varieties are production factors that's needs proper management to improve on sustainable productivity (Zhang et al.2022) Impact of climate change on rainfall pattern affects agriculture production particularly rice as agricultural commodity. In addition, poor level of knowledge and low level of agriculture technology adoption can reduce the rice production and productivity of farmers (Fang et al.2020). The objective of the exercise was to enhance the productivity of farmers through the adaption of improved high yielding rice varieties Orylux6, Sahel 134 and Sahel 177. This among others will also increase the income and improve on the food security status of smallholder farmers.

3. Materials and Methods

The demonstration trial was conducted in Central River Region South during the 2022 dry season production. The rice varieties used for the demonstration were Orylux 6, Sahel 134 and Sahel 177 with land area of 0.5ha. A total of twenty-five (25) kg was used nursery bed preparation for transplanting in the rice field of 0.5ha. Fertilizer grade of NPK 15:15: 15 and Urea 46% were applied using broadcasting method. The demonstration was conducted in Jahally, Pacharr and irrigated perimeters in Central River Region of the Gambia. The sampling method was purposive sampling with a sample size of six (6) selected farmers. The operational field method was systematic rice intensification (SRI) using single plant/stand to enhance production and productivity of the varieties. In addition, all the packages of good agricultural practices were practiced during the production cycle. Furthermore, at harvest average productive tillers were counted, average plant height and average yield were taken in three different locations of each rice variety at different stages of growth. The evaluation process was conducted with the farmers in the form of participatory varietal system (PVS) were the varietal selection was done by the farmers. The selected varieties were tested in the farmers own field for verification to determine their yield stability and tolerance to stresses.

4. Results and Discussion

In the field of research, to collect data, analyze and interpret the results is very important as it guides the researcher to make deceive decision, conclusion and recommendation of the findings. The cultivation or boosting rice production is one of the government's priority to increase the production and productivity of rice. Therefore, committed to policies and programmes that would reduce the importation of rice from other countries at a minimal rate. The was routine observation and monitoring of the demonstration to observe the impact or effect of changes during production cycle of different rice varieties. The demonstration trial observed three (3) parameters such as plant height, panicles/stand, tillering and yield/ha to examine the performance of each crop varieties. The result in Table 1 showed that, Sahel 134 and Sahel 177 registered the same height of one hundred and twenty-six (126) centimeters while least registered height was eighty-three (83) centimeter in treatment 5. The panicle length could be used as indicator to represent the probability of grains amount produced. Moreover, equal to previous parameter, the panicle length of all varieties were same. The impli-

cation of the result is that, convincingly the higher the number of tillers the better the yield. The differences on plant height observed between rice varieties indicated that during the wet season, rice plants grow faster than during the dry season. The shorter plants observed during the dry season production could be attributed to low temperatures observed at an early stage of growth, which might have probably slowed the growth rate (Norke et al. 2016).

The number of primary and secondary ramifications depends on species and varieties. According to imperical evidence one single panicle can bear between 50 and 500 spikelets' in most cultivated varieties their number reaches 150 to 350. Proper water management and optimum condition for light interception could have been the reason for higher number of seeds and seed weight per spike of rice grown under dry season than during the wet season. In the dry season, when light intensity is high, photosynthetic reaction may also be high and more transition of carbohydrates for grain filling with increase in number of seeds per spike of rice. This work lends support from the earlier work (Sridevi V, and Challamuthu V 2015). The panicle initiation during reproductive stage is very critical as this will determine the yield. The formation of panicle entirely depends on the adaption of best agricultural practices especially the timely supply of water and application of fertilizer particularly urea (46%). The application of urea (46%) on split bases will enhance tillering resulting to the formation of panicles with mature grains. In table 2, the result indicates that, the number of panicle/stand is the same as the number of tillers, therefore the lowest number of tillers registered was Orylux 6 while the highest panicle registered was Sahel 134. The average registered amongst the rice varieties was constant and there was no significant difference in terms of tillers/stand of 42, 44 and 46 on average respectively. The number of filled grains formed in panicle highly relied on plant photosynthesis during growing period and gene character of varieties cultivated (Majeed,2016).

The yield of a rice cultivar is dependent not only on the numbers of grains produced per unit area but also on the size and weight of the individual grain. In addition, there are other factors associated with yield increment such as timely farm operations, timely application of fertilizer, water, weed control and pest management. In the dry season, when light intensity is high, photosynthetic reaction may be high and more transition of carbohydrates for grain formation with increased in most yield components of rice. The result in table 3 indicates that, on average Sahel 177 registered the highest yield of 6,793kg while the lowest yield registered was Orylux 6 with 5,940 kg respectively. Importantly, Orylux 6 is highly acceptable for its aroma, excellent grain quality and taste with high market potential. Primarily with maturity rate of 100 days and yields 6.5 t/ha under rain-fed lowland and with higher potential yields in the irrigated ecology Orylux 6, offers the possibility of double cropping. The result therefore, indicated that where irrigation water is available, rice can be grown in the dry season and the grain yield will be higher than in the wet season because of the higher intensity of solar radiation (Majeed et al.2016).

In social research it is important to establish comparison between different independent variables such as plant height, tillers, and yield. The demonstration trial depicts the performance between Orylux 6 and Nerica L19 sub-1 as improved varieties being promoted by smallholder farmers at field level. The trial observed the comparison between farmer practice and that of good agricultural practice to gauge the performance of different rice varieties. The plant with more than 1.2 cm and 1.1cm height was more susceptible to lodging therefore it able to reduce the yield (Deng et al 2019). From the results in table 4, indicate that, Nerica L 19 sub-1 under good agricultural practices tillers more than Orylux 6 of farmer practice shows 98, 52 and 79, 35 respectively. Furthermore, to determine performance is the yield, and from the result table good agricultural practices outweigh the farmer practice. Indicating that, Nerica L19-sub-1 registered 8,600 and 5,600kg while Orylux 6 registered 7,000 and 4,800 kg and average yield scored was 1,600kg and 800kg respectively. The results have an implication on food and nutritional security hence increasing income security. The significant performance of rice grown during the dry season over the rain-fed on tiller count may not be uncounted. According to (Arayawati et al. 2016) high day temperature and solar radiation with low night temperatures are apparently conducive for more panicle production without much reduction in spikelet number. The government should create an enabling environment for private sector participation, provision of production inputs and services of field operations to smallholder farmers on timely basis.

Table 1: Plant height at harvest (cm)

Treatment	Area/ha	Rice varieties		
		Orylux 6	Sahel 134	Sahel 177
1	0.5	65 b	116 a	126 a
2	0.5	118 a	126 a	120 a
3	0.5	111 a	106 a	120 a
4	0.5	118 a	122 a	120 a
5	0.5	112 a	83 b	122 a
6	0.5	108 a	117 a	113 a
Average	3	105	122	120

*Different letters in the same column means significantly different at p >.05

Table 2: Panicles/stand

Treatment	Area/ha	Rice varieties		
		Orylux 6	Sahel 134	Sahel 177
1	0.5	39 b	47 a	46a
2	0.5	43 a	46 a	40a
3	0.5	47 a	43 a	43a
4	0.5	42 a	46 a	45a
5	0.5	43 a	46 a	45a
6	0.5	36 b	46 a	44a
Average	3	42	46	44

*Different letters in the same column means significantly different at p >.05

Table 3: Yield of rice varieties.

Treatment	Area/ha	Rice varieties		
		Orylux 6	Sahel 134	Sahel 177
1	0.5	5850 b	6150 a	7050 a
2	0.5	6000 a	6210 a	6360 b
3	0.5	6000 a	6450 a	7050 a
4	0.5	5490 b	6480 a	6950 b
5	0.5	5700 b	6300 a	6600 b
6	0.5	6600 a	6000 a	6750 b
Average	3	5940	6265	6793

*Different letters in the same column means significantly different at p >.05

Table 4: Physiology of crop growth

Variety	Plant height (cm)		Tillers		Grain Yield ha^{-1}		Average yield
	Farmer Practice	GAP	Farmer Practice	GAP	Farmer Practice	GAP	+ / -
Orylux 6	1.2cm	1.1cm	35 b	52 b	4,800 b	5, 600 b	800
Nerica L19 sub1	1.6cm	1.5cm	79 a	98 a	7,000 a	8, 600 a	+1 600

*Different letters in the same column means significantly different at p >.05

Figures:

5. Conclusion and Recommendation

The farming communities of the Gambia entirely consumed rice on a daily basis and is the main staple food. The government, development partners and agricultural projects had set priorities in policy documents tailored towards enhancing the production and productivity of rice shifting from subsistence farming to commercialization through the value chain process. The Rice Value Chain Transformation project in collaboration with the Department of Agriculture designed a demonstration trail focusing on three (3) improved rice varieties to reduce the yield gap. A trial program was undertaken to transfer the aroma, taste and long-grain characteristics to the most popular varieties in the region and by extension to identify or create quality varieties with high agronomic performance. Basically, the demonstration focuses on how to improve on productivity by timely and efficient land preparation, use of improved rice variety and timely weed control. However, major constraints faced by farmers were low access to improved seeds, inadequate production practices and machinery, limited access to fertilizer and the adverse effects of climate change. Poor storage systems, limited use of improved germplasm, poor soil fertility, and limited access to irrigation facilities were additional constraints. Low access to credit, input and the output markets, weak producer capacity, weak technology transfer system, and weak capacities of producer associations. In conclusion, from the research findings, I conclude that, on average Sahel 177 registered the highest yield of 6,793kg while the lowest yield registered was Orylux 6 with 5,940 kg respectively. In addition, Orylux 6 variety has comparative advantage of high-quality aromatic taste against

Sahel 177 and Sahel 134 and convincingly the higher the number of tillers the more the yield. Therefore, recommending the government to design policies and enabling environment that would encourage public-private participation to bridge the yield gap potentials.

6. Acknowledgement

I would like to register my profound gratitude and sincere appreciation to my lovely wife Madam Kumba Jayfang Sanyang, Omar Sanyang, Khadija Sanyang and Isatou Jayfang for being accommodating during the time of data collection. Appreciation goes to the farmers who were involved in the demonstration trial at Jahally and Pacharr fields for their commitment. The extension workers for their technical back stopping and guidance at the time of the trial. Finally, my gratitude to the RVCTP staff for their steadfastness and support to smallholder farmers, and the management of Regional Agricultural Directorate at Sapu.

References

1. Alfred R, Obit J H, Chin C P Y, Haviluddin H, Lim Y. Towards paddy rice smart farming: A review on big data, machine learning, and rice production tasks. IEEE Access. 2021; 9: 50358-80.
2. Aryawati SAN, dan P. Sutami. Jurnal Pengkajian dan Pengembangan Teknologi Pertanian. 2019; 22(1): 53-65.
3. Bai S W, Yu H, Wang B, Li J Y. Retrospective and perspective of rice breeding in China. J Genet Genom. 2018; 45(11): 603–612.
4. Deng NY, Grassini P, Yang HS, Huang JL, Cassman KG, Peng SB. Closing yield gaps for rice self-sufficiency in China. 2019.
5. FAO. Conservation Agriculture. Food and Agriculture Organization of the United Nations helping to build a world without hunger. 2016.
6. Fang YW, Zhang W, Chen YY, Hou F, Xu LF, Tang CH, et al. State quo of utilization of high-quality hybrid rice varieties in China during 2001–2017. Acta Agric Zhejiang. 2020; 32(1): 1-14.
7. Farooqi, UM, Tahir M, Saleem MA, Ahmad T. Effect of foliar application of irrigated rice seed farmers in Koussin-Lele, Benin Republic. Journal of Development and knowledge and adoption of new cultivars in the Tillabery region of western Niger. 2019.
8. Gupta RK, Sayre K, Ladha JK. Conservation Agriculture in South Asia. RiceWheat Consortium for the Indo-Gangetic Plains, International Maize and Wheat Improvement Center (CIMMYT); International Rice Research Institute (IRRI); and NASC Complex, New Delhi, India. 2016.
9. Ismail N, Malik OA. Real-time visual inspection system for grading fruits using computer vision and deep learning techniques. Inf Process Agric. 2022; 9(1): 24–37.
10. Majeed S, Akram M, Latif M, Ijaz M, Hussain M. Mitigation of drought stress by foliar application of salicylic acid and potassium in mungbean (Vigna radiate L.). Legume Research-An International Journal. 2016; 39(2): 20-214.
11. Nitrogen and boron on growth, yield and quality of wheat (Tritium aestivum L.). Pakistan Journal of Life and Social Sciences. 17(2): 93-99.
12. Norken IN, Suputra IK, Arsana IGNK. Journal of Agricultural Science and Technology. 2016; 215-25.
13. Qian Q, Guo LB, Smith SM, Li JY. Breeding high-yield superior quality hybrid super rice by rational design. Natl Sci Rev. 2016; 3(3): 283–294. Scientia Biologicae 11(1): 138-144.
14. Shrivastava P, Kumar R. Soil salinity: A serious environmental issue and plant growth promoting bacteria as one of the tools for its alleviation. Saudi Journal of Biological Sciences. 2015; 22(2): 123-31.
15. Sow M, Seck PA, Maiga IM, Laing M, Ortiz R, Ndjiondjop M. Farmers' rice Utility of Indigenous Rice (Oryza sativa L.) in Lakhimpur District, Assam, India. Notulae varieties in central Benin? International Journal of Agricultural Sustainability. 2015; 15(1): 1-11.
16. Sridevi V, Challamuthu V. Impact of weather on rice - A review. International Journal of Applied Research. 2015; 1: 825-831.
17. Zeng B. Renovation of main cultivated rice varieties in China in the past 30 years. Crops. 2018; 34: 1.
18. Zhang H, Wang YX, Deng C, Zhao S, Zhang P, Feng J, et al. High-quality genome assembly of Huazhan and Tianfeng, the parents of an elite rice hybrid Tian-you-hua-zhan. Sci China Life Sci. 2022; 65(2): 398-411.