

Researchers' Attitudes towards Varietal Development of Hybrid Rice: A Case Study in Myanmar

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Abstract: The purpose of this study was to identify the existing rice breeding programs in Myanmar and to determine researchers' attitudes on hybrid rice research and its determinants. A sample consists of 56 researchers who are working in Department of Agricultural Research, Department of Agriculture and Yezin Agricultural University, and involving varietal development of hybrid rice. The research instruments were a questionnaire used by 4 points Likert scale of strongly agree, agree, less agree and not agree to measure on researchers' attitudes towards 14 determinants of varietal development of hybrid rice production. The study revealed that the average age of the researchers was 46.5 years ranged from 25 to 60 years. The majority of researchers were 51-60 years old (41.1%). The working experience of researchers ranged from 5 to 36 years and the mean of their experience was 20 years. The educational level was Ph.D. (35.7%), M.Agr.Sc. (26.8%), and B.Agr.Sc. (37.5%). Majority of researchers were female (76.8%) and 58.9% were rice breeders. Moreover, 48.2% of researchers obtained the hybrid rice technology from breeding training and the researchers who believed in their current breeding works were 51.8%. Among 33 rice breeders, 72.7% of the rice breeders applied only convention breeding method. In addition, researchers' opinions on farmer's perception of hybrid rice technology, 60.7% of the researchers agreed on inferior grain quality and 73.2% of researchers strongly agreed on not stable market. This study found out more than half of the researchers strongly agreed on 10 out of 14 determinants such as poor infrastructure, low human resource development, parental problem, insufficient experience, limit germplasm resource, limit research facilities, no incentive for breeders, weak public-private partnership, fewer quality breeders and not enough research fund. Moreover, half of the researchers agreed on 3 determinants likely need special technical training, need international assistance and climate change challenges. Finally, development of hybrid rice research in Myanmar, there will be needed international assistance, and upgraded to hybrid rice research center from currently hybrid rice research section and need integrated hybrid rice policy supported by government.

Key words: Researchers' attitudes, hybrid rice varietal development, determinants.

1. Introduction

The low productivity of agriculture can be attributed to failure to adopt a new technology adequately to some extent. As one option for increasing the agricultural productivity and reducing absolute poverty in rural areas, adopting an improved technology is needed to be considered [1]. Commercial exploitation of hybrid vigor is one of the most important applications of genetics in agriculture. It has not only contributed to food security, but has also benefited the environment [2]. Hybrid Rice was first commercially cultivated in China in 1976 and its

area had been expanded to more than 13 million hectares by 1990, it has been proven to have 20% yield advantage over inbred rice in China [3]. During the last decade, Vietnam, India, Philippines, Bangladesh and United States have also started its commercial cultivation. Hybrid rice not only has a distinct yield advantage over conventional varieties but also is more responsive to fertilizers and can adapt to varying environment [4].

Food security and nutrition is a major role in Myanmar and largely affected farmer's decision and technical efficiency of rice production. Myanmar started research on hybrid rice in 1991 and released its hybrid seeds in 2014. Hybrid rice production activities in Myanmar are being pursued by both public and

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private sectors. The private sector primarily was dominated by Chinese seed companies, which are involved mainly in the dissemination of Chinese-bred hybrid [5]. Hybrid rice technology becomes a promising way to raise level of production. The country needs to increase rice production for demand of growing population as well as for the development of economy in the future [6]. Hybrid rice development in Myanmar has been hampered by several nontrivial scientific and technical challenges. It has applied a narrow germplasm base that poses significant constraints on producing the marketable hybrids with yield advantages preferred by farmers and the grain qualities preferred by consumers. An additional challenge has been the multiplication of hybrid rice seeds in significant levels of quantity and quality. On the other hand, joint venture seed Co.Ltds conducted seeds production using Chinese parental lines and delivered F1 seeds to farmers in country. Moreover, some seed Co.Ltds imported the F1 seeds from China, India and Philippine. As a result, there could be competitive with imported parental lines and F1 seeds for farmers' preference and economy for seed producers.

In Myanmar, DAR (Department of Agricultural Research) is a responsible institute for developing new improved crop varieties of good yield, quality and resistant to biotic and abiotic stress. Remarkable successes of crops breeding were achieved in rice, maize and pulses during past decades. There are 13 hybrid rice breeders who are working at Hybrid Rice Section of DAR. However, it has inadequate manpower, insufficient facilities and not enough budgets for developing new rice varieties. Hybrid rice breeding uses several concept, skill and procedures, which are striking different from those, used for inbred rice breeding. Breeders must learn these before initiating a comprehensive hybrid rice-breeding program [7]. There will be estimated to technical efficiency of rice and hybrid rice breeders and related researchers to identify its determinants and examined

the relationship of the various attributes with hybrid rice research.

1.1 Objectives

(1) To identify the existing rice breeding programs in Myanmar.

(2) To determine researchers' attitudes towards hybrid rice research and its determinants.

1.2 Background of Hybrid Rice Development in Myanmar

Hybrid rice has the potential to benefit a wide range of stakeholders. Considering the prospects of covering a large area under hybrid rice in the country, the farmers, rice consumers, seed growers, farm laborers and seed companies would get benefits from the technology. Therefore, hybrid rice research has been initiated in Myanmar since 1991 with the introduction of two CMS (cytoplasmic male sterile) lines, IR 62829A and IR 58025A from International Rice Research Institute, IRRI, Philippines. The first two hybrids, hybrid 1, (IR 62829A/Theehtatyin) and hybrid 2 (IR 62829A/Shwetweyin) were obtained. The yield advantage was not, however obviously higher than pure line varieties. Hybrid rice research and development program has been undertaken as a collaborative effort between Myanmar Agriculture Services and Marubeni Cooperation, Japan in 1997 funding under FAO (TCP) project [8]. Since 1997, it has been carrying out research on hybrid rice at the Hmawbi, Yezin and Kyaukse Farms, in conjunction with the Marubeni Corporation of Japan and from the summer paddy season of 1999-2000, hybrid seeds were experimentally produced at the Hmawbi and Mandalay Farms. Similarly, hybrid rice production was being undertaken in cooperation with the Sima Company and Shaung Fang Company from China. Under the Project, four hybrid rice experts from China trained Myanmar researchers at Yezin in the technologies of hybrid rice culture and seed production. And later on, multiplier courses were

given to more than 70 personnel from Research Farms, Seed Farms and Agriculture Education Division. In order to food security purpose, Northern Shan State Area of Myanmar introduced China hybrid rice seeds which were delivered to farmers and also tested the hybrid seed production since 2004. And then MOAI (Ministry of Agriculture and Irrigation) has been jointed with Chinese company for hybrid rice seed production by using Chinese parental line restarted since 2011, monsoon season. MOAI has increased seed production area and spread out nationwide. At the same time, it has encouraged private sector to participate in hybrid rice activities and supported to establish hybrid rice seed companies. As a result, it has become 2-3 hybrid rice seed companies to do the seed production using Chinese parental lines and delivered to farmers and created hybrid rice seed markets without systematic research. On the other hand, DAR created own parental lines assisted by IRRI, Hybrid Rice Development Consortium. Current breeding program, development of 3 kinds of own hybrid varieties were already identified nevertheless these are not competitive with the foreign hybrid rice varieties. Therefore, biotechnology section is supported by analyzing for hybrid rice A, B, R and searching for purity percentage of parental lines by using marker-assisted selection for hybrid rice varietal development program. However, DAR is encountering the technical constraints as low heterosis level of inter-varietal hybrids, lack of germplasm source, and identification of restorers by conventional test-crossing procedures is quite laborious and skilled persons, limit WA (Wild Abortive) cytoplasm source, poor seed quality of parental lines, weakness in seed production technology and less utilization of molecular breeding [9].

2. Research Methodology

The descriptive study was conducted to analyze the researchers' attitudes towards varietal development of hybrid rice program and its determinants. A structured

interview schedule was used to collect data from researchers. The researchers were randomly selected from DAR (Department of Agricultural Research), DOA (Department of Agriculture) and YAU (Yezin Agricultural University). The total number of researchers was 56 including 33 breeders who were conducting priority to rice and hybrid rice breeding programs. Beside, researchers who were conducting researches of plant production and protection field related to hybrid rice varietal development were also selected. The interview schedule consisted of two parts: (1) background information of researchers and sources of hybrid rice technology and (2) researchers' attitudes toward hybrid rice research and farmers' perception. Researchers' attitudes were measured by using modification of 4 points Likert scale of strongly agree, agree, less agree and not agree [10]. The researchers were asked to give their attitudes for 6 statements of farmers' perception on high seed price, low interest to grow, inferior grain quality, low grain price, weak contract farming and not stable marketing. Regarding to hybrid rice technology development, there were 14 determinants such as infrastructure, human resource development, parental lines problem, experience, germplasm resource, training need, research facilities, incentives for researchers, public private partnership, international assistance, climate change challenges, qualify breeder, research fund and mindset of researchers. The process of data collection was completed from August to December 2017.

3. Results and Discussion

3.1 Researchers' Background Information

The average age of the researchers was 46.5 years ranged from 25 to 60 years. The majority of researchers were 51-60 years old (41.1%). The working experience of researchers ranged from 5 to 36 years and the mean of their experience was 20 years. The educational level was Ph.D. (35.7%), M.Agr.Sc. (26.8%), and B.Agr.Sc. (37.5%). Majority of researchers were

Table 1 Researchers' background information.

Background information	Respondent (n = 56)	
	Frequency	Percent
Age (mean = 46.5 years)		
25-30	1	1.8
31-40	14	25.0
41-50	18	32.1
51-60	23	41.1
Sex		
Female	43	76.8
Male	13	23.2
Level of education		
B.Agr.Sc.	21	37.5
M.Agr.Sc.	15	26.8
Ph.D.	20	35.7
Year of employment (mean = 20 years)		
1-10	5	8.9
11-20	32	57.2
21-30	4	7.1
Above 30	15	26.8
Research area		
Rice breeding	33	58.9
Soil and water	5	8.9
Plant protection	5	8.9
Economics	3	5.4
Agronomy	8	14.3
Plant genetic	2	3.6
Belief on current breeding procedure		
100%	29	51.8
75%	1	1.8
50%	6	10.7
No decided	20	35.7

female (76.8%) and (58.9%) were rice breeders and the researchers (51.8%) believed in their current breeding works (Table 1).

3.2 Source of Information for Technological Knowledge

More than half of researchers (51.8%) did not receive training of the hybrid rice technology however, 48.2% obtained hybrid rice technology from breeding training, and also 57.1% of researchers learned from senior researchers who have experience in hybrid rice. A few of researchers got knowledge from internet (17.9%) and learned by themselves (30.4%) for getting the hybrid rice technological knowledge and

breeding protocol (Table 2).

3.3 Current Applied Breeding Methods

Out of 56 researcher, 33 were rice breeders and 72.7% applied conventional method and 9.1% of them utilized the combined approach as conventional and molecular and applied the molecular and anther culture method was used by 6.1% of researchers and only 12.1% applied with combination of conventional, molecular, and anther culture (Table 3). This study revealed that majority of rice breeders has no access to biotechnology which was accurate for varietal development.

3.4 Researchers' Opinion on Farmers' Perception of Hybrid Rice Production

This study found out that 32.2% researchers strongly agreed and 44.6% of the researchers agreed on high seed price. Moreover, 42.9% and 46.4% of the researchers mentioned they strongly agreed and agree on farmers' low interest to grow hybrid rice respectively.

Table 2 Sources of technology information.

Source of information	Frequency	Percent
Breeding training		
Yes	27	48.2
No	29	51.8
Internet		
Yes	10	17.9
No	46	82.1
Senior officer		
Yes	32	57.1
No	24	42.9
Self study		
Yes	17	30.4
No	39	69.6

Table 3 Current applied breeding methods by researchers.

Breeding method	Respondent (n = 33)	
	Frequency	Percent
Conventional	24	72.7
Conventional and molecular	3	9.1
Molecular and anther culture	2	6.1
Convention and molecular and anther culture	4	12.1

Besides, majority 60.7% of the researchers agreed on inferior grain quality of hybrid rice. On the other hand, less than 50% of researchers strongly agreed on low grain price and weak contract farming. However, 73.2% of researchers' opinion showed they strongly agreed on not stable market of hybrid rice (Table 4).

3.5 Researchers' Attitudes towards Determinants of Hybrid Rice Technological Development

This study revealed that more than half of researchers strongly agreed on inadequate infrastructure (58.9%), weak human resource development (57.1%), parental problem (60.7%), insufficient experience (69.6%), limit germplasm resources (55.4%), limit research facilities (57.1%) and no incentives (66.1%). Moreover, there were also some people who strongly agreed on weak public private partnership research

(58.9%), fewer quality breeders (58.9%), not enough research funds (54.6%). Only 46.4% of researchers strongly agreed on need to change mindset of the breeders. On the other hand, need of special technical training was agreed by 50% of researchers and 55.4% of researchers just agreed on international assistance and 53.6% of the farmers were agreed to climate change challenges.

As results of this study most of the researchers showed their attitudes which mentioned inadequate infrastructure, limit facilities and germplasm resources, weak in technical know-how and capacity and challenges to climate change, weak research partnership and inadequate quality breeders and not enough research fund for research activities to success. Similar finding was reported by Refs. [11, 12]. It might be due to uncertainty and dissatisfaction of their works. Moreover, majority of researchers might hope to

Table 4 Researchers' opinion on farmers' perception of hybrid rice production.

Statements	Respondent (%) n = 56			
	Strongly agree	Agree	Less agree	Not agree
High seed price	32.2	44.6	23.2	0
Farmers low interest to grow	42.9	46.4	8.9	1.8
Inferior grain quality	21.4	60.7	16.1	1.8
Low grain price	34.5	36.4	25.5	3.6
Weak contract farming	41.1	46.4	10.7	1.8
Not stable market	73.2	21.4	3.6	1.8

Table 5 Researchers' attitudes towards determinants of hybrid rice technological development.

Statements	Respondent (%) n = 56			
	Strongly agree	Agree	Less agree	Not agree
Inadequate infrastructure	58.9	35.7	1.8	3.6
Weak human resource development	57.1	35.7	3.6	3.6
Parental problem	60.7	26.8	5.4	7.1
Insufficient experience	69.6	26.8	1.8	1.8
Limit germplasm resource	55.4	39.3	1.8	3.6
Need special technical training	48.2	50.0	1.8	0
Limit research facilities	57.1	41.1	1.8	0
No incentives	66.1	30.4	1.8	1.8
Weak public private partnership	58.9	37.5	1.8	1.8
Need international assistance	35.7	55.4	8.8	0
Climate change challenges	32.1	53.6	10.7	3.6
Fewer quality breeder	58.9	33.9	5.4	1.8
Not enough research fund	54.6	29.1	12.7	3.6
Need mindset change	46.4	37.5	14.3	1.8

get incentives as breeder right according to the plant variety protection law for their new innovation. Besides, they expect to fulfill the fruitful opportunity that changed from inferior condition next coming five years.

4. Conclusion and Recommendations

This study highlighted well developed research on hybrid rice is crucial for future in Myanmar. Myanmar needs parental germplasm that can develop own parental lines and try to be comparative advantages with foreign parental lines for hybrid rice varietal development. On the other hand, hybrid rice researchers in Myanmar were insufficient experience and no incentives for their achievements. To develop hybrid rice research, Myanmar will search opportunity to get international assistance such as hybrid rice research center by China or India. At the same time, hybrid rice research section in Department of Agricultural Research should be upgraded own center conducting for hybrid rice research and need policy intervention by government including integrated hybrid rice research policy. Therefore it is recommend that:

- Special research program for creation of own parental lines and a well funded Hybrid Rice Research Center;
- Extensive human resource development programs for rice breeders and researchers;
- Development of an effective research network involving DAR, DOA, YAU and international organization, private seed Co. Ltds and establishing effective linkage among the partners;
- Effective regulation of seed companies to maintain consistent quality and affordable price;
- A marketing policy that grants subsidy based seed system.

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