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Validating introduced commercial rice varieties for registration based on their adaptability and farmers' feedback at Fogera and Pawe, Northwest Ethiopia

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ABSTRACT

Field experiment was conducted at Fogera and Pawe research stations to evaluate the adaptability and performance of introduced commercial lowland rice varieties for variety registration. Farmers' feedback was also collected to complement agronomic performance of the varieties in terms of selected traits; growth duration, plant height, panicle length, spikelets fertility and caryopsis color. Six varieties were replicated over three sites (one on station and two on farmers' field) at each location with plot size of 10m x 10m per variety. The analysis of variance revealed very highly significant difference (p=0.001) for days to heading both at Fogera and Pawe but only at Fogera for days to maturity. Grain yield was significantly different (p=0.05) at Fogera but not at Pawe while the interaction was significant. All candidate and check varieties showed higher grain yield performance at Pawe than at Fogera. Variety 'TANZANIA Tai' (4929 kg/ha), followed by 'KOMBOKA' (4465 kg/ha) performed best in grain yield at Fogera while 'KOMBOKA' (5738 kg/ha) and 'TXD 306' (5168 kg/ha) at Pawe. Combined across two locations, 'KOMBOKA' (5101 kg/ha) ranked first in grain yield, followed by 'TANZANIA Tai' (5003 kg/ha). Farmers also ranked 'KOMBOKA' as their first choice at Pawe and 'X-JIGNA' (Check 2) at Fogera. Following grain yield performance, uniformity and farmers' feedback, national variety release committee approved 'KOMBOKA' for registration as variety in Ethiopia. As a result, 'KOMBOKA' was registered by the name 'Fogera 2' for cultivation in Pawe and other areas which are characterized by high temperature and sufficient rain fall with fair distribution of high relative humidity. The variety was also recommended for cultivation by private rice growers in the low elevation areas of Ethiopia such as Gambella and South Nations Nationalities and Peoples regions.

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***Keywords*:** Rice, *Oryza sativa,* grain yield, farmers, private rice growers, Fogera, Pawe

1. INTRODUCTION

Rice (*Oryza sativa* L., 2n = 2x = 24) is the second most widely grown cereal crop and the staple food for more than half of world's population, providing two thirds of calorie intake for more than three billion people in Asia and one third of calorie intake of nearly 1.5 billion people in Africa and Latin America [1]. It has become the most popular food crop in many African countries where domestic production, however, failed to meet local demand due to a rapid shift in food habit and urbanization coupled with increased population [2]. Cultivated Asian rice is believed to have been introduced into Ethiopia in the late 20th century probably at first by North Koreans and latter by other actors at different times in connection with technical cooperation and development aids [3]. Fogera (Amhara region), Abobo (Gambella region) and Pawe (Benishangul-gumize region) are assumed to first points of entry [4]. In Ethiopia, rice occupies more than 60 thousand ha annually and contributes about 171, 854 tones of to annual grain production in the country with increasing trend both in area and total production [5]. Currently, rice is grown in almost all regions including Amhara, Tigray, Oromia, Benshangul-gumize, South NNP, Afar, and Somalia regions predominantly by smallholder farmers with an estimated average yield of about 2.8 t/ ha, which is significantly lower than experimental plots yield as well as yields of global average, 4.46 t/ha [6].

The rice variety improvement research in Ethiopia has focused mainly on the introduction of rice germplasms from a range of different sources, including the International Rice Research Institute (IRRI), the Africa Rice Center (WARDA), and other regional researches centers. Most often the research concentrates on the evaluation for adaptation and release of new varieties for local producers and more than 30 improved varieties have already been released though only some are adopted. Under the collaboration frame work of East Africa Agricultural Productivity Project (EAAPP), three improved and commercial lowland rice varieties were distributed to EAAPP member countries in east Africa; Ethiopia, Uganda, Keneya and Ruwanda from Tanzania- a leading country for EAAPP rice component project. The collaboration aimed at facilitating regional variety release and registration. In this regard, rice program in Ethiopia managed to introduce these commercial rice varieties for evaluation and registration to quench the demands of high yielding and input response rice varieties that can be cultivated by smallholder farmers and /or private rice growers. The introduced three varieties namely 'KOMBOKA', 'TANZANIA Tai' and 'TXD 306' were evaluated at two major rice growing areas in Ethiopia, Fogera and Pawe, for variety registration based on their agronomic performance and farmers' feedback, and following evaluation by national variety release technical committee.

2. MATERIALS AND METHODS

2. 1. Description of experimental sites

The field experiment was conducted at Fogera (Woreta station) in Amhara Region and at Pawe station in Benshangul Gumize Region (Figure 1) during 2014/15 cropping season.

Fogera (Woreta station) lies on Latitude 11^{o} 58’ N and Longitude 37^{o} 41’ E at an elevation of 1810 m above sea level (masl).

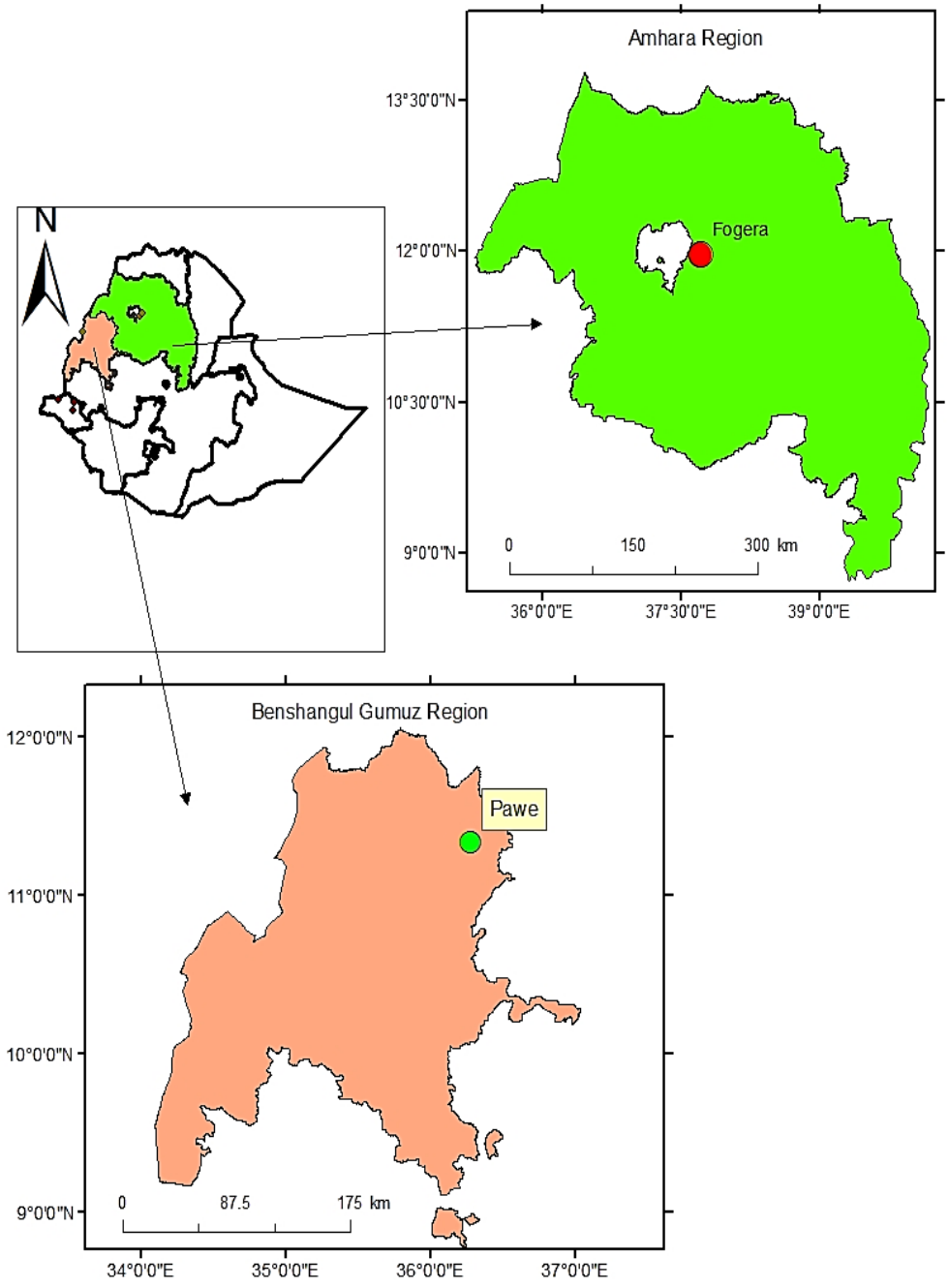

Figure 1. Map showing experimental sites in Northwest Ethiopia

The average annual rainfall is about 1300 mm which mainly distributed between June and September (the main rice growing months). The rainfall is characterized by uneven distribution in total amounts, time and space and terminal moisture stress is a frequent phenomenon.

The temperature ranges from mean minimum of 11.5 °C to mean maximum of 27.9 °C with the soil type of Vertisol. Pawe station is located in Pawe district in Benishangul-Gumize Region. It lies on Latitude 11° 09' N and Longitude 36° 03' E at an elevation of 1050 masl. The average annual rainfall is about 1457 mm which mainly distributed between May and November, the main rice growing months. The area receives heavy annual rain fall for long periods of good distribution over time and space. The temperature ranges from mean minimum of 17.17 °C to mean maximum 32.75 °C with the soil type of Cambisol.

2. 2. Plant materials, experimental design and trial management

The three varieties namely; 'KOMBOKA', 'TANZANIA Tai' and 'TXD 306', introduced from Tanzania through East Africa Agricultural Productivity (EAAP) rice project, were evaluated against three checks; ''EDIGET'', ''X-JIGNA'', and 'HIBRE' (Table 1). 'EDIGET' is cold tolerant and early maturing lowland improved variety. HIBRE is also early maturing lowland improved rice variety, whereas 'X-JIGNA' is the most popular local cultivar cultivated for more than 30 years in Fogera areas with intermediate maturity. All the varieties (candidates and Ethiopian) have white caryopsis color, one of the most important market traits. All six varieties were replicated over three sites (one on station and two on farmers' field) at each experimental site with a plot size of 10 m x 10 m per variety. Seed rate of 60kg/ha was used and fertilizers (Urea and DAP) were applied as per local recommendations. DAP was applied all at planting while Urea used in three splits; planting, tillering and booting stages. Each experimental unit was properly managed uniformly at each experimental site.

Table 1. Description of rice varieties considered in this study.

Varieties	Type	Caryopsis color	Source*
KOMBOKA	Lowland	White	Tanzania
TANZANZANIA Tai	Lowland	White	Tanzania
TXD 306I	Lowland	White	Tanzania
EDIGETI' (Check1)	Lowland	white	Fogera RRTC, Ethiopia
HIBREE (Check2)	Lowland	white	Fogera RRTC, Ethiopia
X-JIGNA' (Check3)	Lowland	white	Fogera RRTC, Ethiopia

* RRTC: rice research and training centre

2. 3. Data collection and analysis

Observations pertaining to agronomic and yield attributing traits were recorded from each experimental plot, either on plant or plot basis as required. Thus, data were collected for days to 50% heading (DTH), days to 80% maturity (DTM), panicle length (PL), plant height (PH), filled grains per panicle (FGP), spikeletes fertility rate (FR), grain yield (Gy) and thousand seed weight (g). Grain yield harvested was adjusted at 14% moisture content and covered to kg/ha.

Phenotypic acceptability and disease reaction of varieties were also scored. The grain yield, yield components and other characteristics were determined according to the method of Standard Evaluation System for Rice [7]. The reaction for major rice disease reactions were also scored as per to the standard. Leaf and panicle blast were scored with scale of 0, 1, 3, 5, 7 and 9, where 0: no lesion at all and 9: leaves covered with lesions) and brown spot was scored with scale of 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, where 0: no incidence and 9: 76-100% incidence (IRRI, 1996). Farmers scored each variety in terms of selected traits; plant height, panicle length, growth duration, spikelets fertility, caryopsis color based on 1-5 scale (1: best, 5: worst) and then varieties were ranked based on average values of scores across traits considered. Quantitative data collected were subjected to statistical analysis using GenStat (16.2th version) software [8] to find out significant differences between the means of different traits of the varieties.

3. RESULTS AND DISCUSSION

3. 1. Variation in agronomic and yield traits

The descriptive statistics for agronomic and yield traits revealed that except for panicle length, plant height, and spikelests fertility rate, all other traits considered exhibited wider variation at Fogera than at Pawe as explained by higher standard deviation (SD) (Table 2). Days to heading, for instance, ranged from 81 to 120 days (SD = 12.40) at Fogera and from 76 to 117 days (SD = 12.2) at Pawe. Similarly, filled grains per panicle ranged from 60 to 105.6 grains (SD = 13.3) at Fogera and from 76.2 to 122.6 grains (SD = 12.2) at Pawe. Grain yield also ranged from 1640 kg/ha to 6050 kg/ha at Fogera while at Pawe from 3629 kg/ha to 6721kg/ha with standard deviation of 1382 kg/ha and 942.9 kg/ha, respectively (Table 2).

Table 2. Descriptive statistics of agro-morphological traits of rice varieties at Fogera and Pawe.

Traits	Fogera				Pawe			
	Minimum	Maximum	Mean	SD*	Minimum	Maximum	Mean	SD*
DTH	81.0	120.0	96.6	12.4	76.0	117.0	90.1	12.2
DTM	111.0	159.0	132.4	16.2	111.0	152.0	123.6	11.9
PL	15.8	22.2	18.7	1.7	16.6	30.2	20.1	3.0
PH	62.0	94.8	74.5	9.9	55.2	120.8	95.4	18.8
FGP	60.0	105.6	81.5	13.3	76.2	122.6	103.2	12.2
FR	92.3	97.7	95.1	1.7	95.5	100.0	98.1	0.9
Gy	1640.0	6050.0	3560.0	1382.0	3629.0	6721.0	4896.0	942.9
TSW	19.0	35.0	26.9	4.8	20.0	31.5	26.0	3.6

*Standard deviation, DTH: days to heading (days), DTM: days to maturity (days), PL: panicle length (cm), PH: plant height (cm), FGP: filled grains /panicle (no), FR: fertility rate (%), Gy: grain yield (kg/ha), TSW: thousand seed weight (g).

Variations were also examined based on analysis of variance for each location and in combined data across two locations. Varieties were significantly different for six of eight traits at Fogera (days to heading and maturity, plant height, filled grains per panicle, grain yield and thousand seed weight) and for four traits at Pawe (days to heading and maturity, panicle length and thousand seed weight) (Tables 3, 4). The interaction effect between locations and varieties was also significantly different in all traits considered except for spikielets fertility rate (Table 5). Similar results were reported by [9-20] in which different rice varieties exhibited significant variation for yield and yield related traits such as plant height, panicle length, number of filled grains per panicle, and thousand seed weight.

On average, each rice variety had shorter days to heading and maturity, and significantly higher grain yield with longer plan height at Pawe than at Fogera (Tables 3, 4). The average days to heading and days maturity ranged from 85 to 118 days (mean = 96.6 days) and 116 to 156 days (mean = 132.4 days) at Fogera, respectively while at Pawe from 81 to 113 days (mean = 90.1 days) and 115 to 140 days (mean = 123.6 days), respectively (Tables 3, 4). At both locations, the variety 'EDIGET' showed the shortest growth duration while 'TXD 306' had the longest growth duration. Two candidate varieties, 'KOMBOKA' and 'TANZANIA Tai', were also very late compared to the check rice varieties with days to maturity of 142 days for each at Fogera, and 127 and 126 days at Pawe, respectively (Tables 3, 4). The combined data also showed similar trend (Table 5). Very long growth duration of candidate varieties at Fogera could be attributed to low temperature due to high elevation. In Fogera plains, terminal moisture stress is a common problem in lowland rice cultivation where early maturing rice varieties are required [21]. Thus, the result suggested that the current candidate varieties could not fit to Fogera rice production conditions though their overall mean grain yield performance was higher than the check varieties. Late varieties not only exposed to terminal moisture stress but they also hinder double cropping which is a common practice in Fogera areas.

Panicle length was a little longer for candidate varieties than check varieties ranging from 17.7 cm to 20.1 cm (mean = 18.7 cm) at Fogera and from 17.7 cm to 24.0 cm (mean = 20.1 cm) at Pawe while plant height ranged from 64.0 cm to 90.6 cm (mean = 74.5 cm) at Fogera and from 72.9 cm to 116.5 cm (mean = 95.4 cm) at Pawe (Table 3, 4). Generally, plant high of each variety was longer at Pawe than at Pawe. On the other hand, at both locations, candidate varieties were shorter in plant height compared to the check varieties, 'TANZANIA Tai' being the shortest and 'X-JIGNA' the longest based on the combined data (Tables 3, 4, 5). This short plant height architecture could help receive high fertilizer inputs with no logging effect and result in high grain yield particularly in areas such as Pawe areas where high biomass yield (straw yield) is not a priority. However, in Fogera areas rice varieties with short plant height which will have low biomass yield are not priority for rice growers as straw yield is equally important for animal feed.

The performance of candidate and check varieties for important yield component traits such as filled grains per panicle, fertility rate and thousand seed weight were a little higher at Pawe than at Fogera (Tables 3, 4). The highest filled grains per panicle was recorded from 'KOMBOKA' variety both at Fogera and Pawe with mean values of 92.4 and 116 grains, respectively while the lowest was recorded by 'HIBRE' (66.6 grains) at Fogera and 90.3 grains

at Pawe for 'TANZANIA Tai' variety with grand mean values of 81.5 and 103.2 grains per panicle at Fogera and Pawe, respectively (Tables 3 & 4). Fertility rate also varied from 94.3 to 96.5% with mean of 95.1% at Fogera while at Pawe from 97.1 to 98.8% with mean of 98.1%. Similarly, thousand seed weight ranged from 19.7 g to 32.7 g and Fogera and from 21.0 g to 30.3 g at pawe (Tables 3 & 4). At Fogera, 'TANZANIA Tai' gave the highest grain yield of 4929 kg/ha, followed by 'KOMBOKA' (4465 kg/ha) and the lowest grain yield of 2203 kg/ha was obtained from 'X-JIGNA' (Table 3). At Pawe, 'KOMBOKA' produced significantly the highest grain yield of 5738 kg/ha and the lowest of 4277 kg/ha for 'X-JIGNA' (Table 4). This result demonstrated that the candidate variety, 'KOMBOKA', performed best in grain yield at Fogera and Pawe and 'X-JIGNA' was the lowest yielding among the check varieties at both locations. The combined data across the two locations also confirmed that 'KOMBOKA' was the highest yielding (5101 kg/ha), followed by 'TANAZANIA Tai' (Table 5). As a result, 'KOMOBOKA' can be recommended for the two areas for cultivation. However, although the variety has white caryopsis color in addition to its high grain yield performance, it might not be accepted in Fogera areas where terminal moistures is a common problem and variety with high plant is required because of its high biomass yield for use as cattle feed.

Similar study was conducted using 13 different rice varieties at Kemashi Zone of Benishangul-gumize region by [9] during 2013 main cropping season and found that NERICA-4 and NERICA-15 were the leading varieties among the tested varieties and recommended for Kemashi areas. Similarly, [11] evaluated 11 rice varieties in 2015 cropping season at six environments of Western Ethiopia and found that 'Adet' and 'Hidassie' were high yielding and stable varieties across six environments. As reported by [14] the variety 'Adet' was found to be the most adapted and high yielding variety among eight varieties tested at Maitsebri, Mezekire and Humara areas of Northern Ethiopia during main cropping seasons of 2016 and 2017.

Table 3. Mean performance of six rice varieties at Fogera.

Variety	DTH	DTM	PL	PH	FGP	FR	TSW	Gy
KOMBOKA	101	142	20.1	69.1	92.4	96.5	19.7	4465
TANZANZANIA Tai	102	142	19.6	68.3	83.4	95.5	24.7	4929
TXD 306	118	156	17.7	64.0	83.4	94.3	26.3	3603
EDIGETI' (Check1)	85	116	17.8	81.6	75.0	95.2	32.7	3571
X-JIGNA' (Check2)	88	122	19.3	90.6	88.1	95.4	27.3	2203
HIBREE (Check3)	85	117	17.8	73.5	66.6	93.9	30.7	2589
Mean	96.6	132.4	18.7	74.5	81.5	95.1	26.9	3560
CV (%)	2.4	1.4	5.9	3.6	8.4	1.8	9.3	27.5
LSD	4.2	3.4	2.0	4.9	12.5	3.2	4.5	1780
Sign.(0.05)	***	***	ns	***	**	ns	***	*

DTH: days to heading (days), DTM: days to maturity (days), PL: panicle length (cm), PH: plant height (cm), FGP: filled grains /panicle (no), TSW: thousand seed weight (g), Gy: grain yield (kg/ha), *, **, and *** significant at 0.05, 0.01, and 0.001 levels

Table 4. Mean performance of six rice varieties at Pawe.

Variety	DTH	DTM	PL	PH	FGP	FR	TSW	Gy
KOMBOKA	87	127	20.1	83.3	116.0	98.4	21.0	5738
TANZANZANIA Tai	89	126	21.0	82.9	90.3	97.1	23.3	5077
TXD 306	113	140	24.0	72.9	103.7	98.3	26.0	5168
EDIGET (Check1)	81	115	17.7	114.9	100.9	98.8	29.8	4729
X-JIGNA (Check2)	85	117	19.9	116.5	109.1	98.1	25.7	4277
HIBRE (Check3)	85	117	17.4	102.0	99.3	98.1	30.3	4385
Mean	90.1	123.6	20.1	95.4	103.2	98.1	26.1	4896
CV (%)	5.3	6.2	11.4	6.2	11.1	1.9	4.4	13.2
LSD	8.64	13.98	4.16	10.81	20.86	1.55	2.07	1174.8
Sign.(0.05)	***	*	**	Ns	ns	ns	***	Ns

DTH: days to heading (days), DTM: days to maturity (days), PL: panicle length (cm), PH: plant height (cm), FGP: filled grains /panicle (no), TSW: thousand seed weight (g), Gy: grain yield (kg/ha), *, **, and *** significant at 0.05, 0.01, and 0.001 levels

Table 5. Combined mean performance of six rice varieties at Fogera and Pawe.

Variety	DTH	DTM	PL	PH	FGP	FR	TSW	Gy
KOMBOKA	94	134	20.1	76.2	104.2	97.4	20.3	5101
TANZANZANIA Tai	96	134	20.3	75.6	86.8	96.3	24.0	5003
TXD 306	116	148	20.8	68.5	93.5	96.3	26.2	4386
EDIGET (Check1)	83	115	17.7	98.2	88.0	97.0	31.3	4150
X-JIGNA (Check2)	86	120	19.6	103.6	98.6	96.7	26.5	3240
HIBREE (Check3)	85	117	17.6	87.7	83.0	96.0	30.5	3487
Mean	93.3	128.0	19.4	85.0	92.3	96.6	26.5	4228

CV	4.7	4.3	9.1	7	11.8	1.4	7.1	20.2
LSD	7.43	9.38	2.99	10.06	18.39	2.27	3.2	1446
Sign.(0.05)	**	*	**	***	*	Ns	**	*

DTH: days to heading (days), DTM: days to maturity (days), PL: panicle length (cm), PH: plant height (cm), FGP: filled grains /panicle (no), TSW: thousand seed weight (g), Gy: grain yield (kg/ha), *, **, and *** significant at 0.05, 0.01, and 0.001 levels

3. 2. Diseases reaction, phenotypic acceptability and farmers' evaluation

Diseases reaction was scored based on visual observation, following standard evaluation system for rice of International Rice Research Institute [7]. As presented in Table 6, disease reaction score for leaf blast ranged from 0.3 for 'EDIGETI' and 'X-JIGNA' to 3 for 'TXD 306'; panicle blast from 0.3 for 'KOMBOKA' to 1.7 for 'TANZANIA Tai' and 'X-JIGNA' and brown spot from 0.7 for 'HIBRE' to 3 for 'TXD 306'. Results demonstrated that except for ''TXD 306' which showed high diseases reaction score in leaf blast and brown spot, all other varieties showed relatively strong resistance to rice diseases (Table 6). Thus, 'KOMBOKA' the highest yielding variety with white caryopsis color complemented with high resistance to three major rice diseases can be one of the possible varieties for recommendation. The overall phenotypic acceptability score also demonstrated that 'KOMBOKA' and 'EDIGET' showed the best score.

Moreover, farmers' evaluation and ranking of the varieties based on visual observation with reference to selected agronomic traits was presented in Table 7. As illustrated, varieties were ranked differently at Fogera and Pawe based on the same traits at two sites. At Fogera, 'X-JIGNA' ranked 1st, followed by 'EDIGET' and 'HIBRE' while candidate varieties ranked 4th to 6th which could be attributed mainly to their short plant height and long growth duration compared to the check varieties. In this study, almost all check varieties showed short growth duration and longer plant height, both of which are farmers' preferred traits in Foger areas. Late maturing varieties do not encourage double cropping in Fogera areas where double cropping is practiced after rice in the same year. In areas where long growth period crops cultivated, only a single crop could be grown per year [22]. Dingkuhn, [23] also reported that rice growth duration is a primary decisive factor of crop production in double-season rice systems and shortening the growth duration is beneficial for the implementation of the seasonal double cropping of rice.

Unlike Fogera, at Pawe 'KOMBOKA' and 'TANZANIA Tai' ranked 1st and 2nd. The other candidate variety, 'TXD 306', ranked 5th based on farmers' preference although it was the 2nd and 3rd high yielding variety at Pawe and in combined data, respectively (Tables 3, 4, 5,7). This could be attributed to its extremely long growth duration at Pawe and overall poor phenotypic acceptability (Tables 5, 6). At Pawe, check varieties were not preferred by farmers and hence ranked last. Pawe area is known by favorably high temperature and long rain fall season with good distribution and moisture stress is not a problem. Farmers in this area do not prefer early maturing rice varieties (informal personal interview). Early varieties are attacked by birds and panicles may sprout in the field and, thus most farmers preferred intermediate to late maturing rice varieties. Evaluation and ranking of rice varieties by farmers clearly demonstrated significance of farmers' involvement in variety evaluation and selection based on

priority traits of interest. Overall results suggested that 'KOMOBOKA' could be recommended for Pawe areas. The other better performing candidate variety, 'TANZANIA Tai', can also be considered as the second option and/or used in crossing breeding program to improve local cultivars.

Table 6. Disease reactions and phenotypic acceptability of six rice varieties at Fogera and Pawe.

Variety	LB	PB	BS	Phac
KOMBOKA	1.7	0.3	1.0	1.0
TANZANZANIA Tai	1.7	1.7	1.3	1.7
TXD 306	3.0	1.3	3.0	1.7
EDIGETI (Check1)	0.3	1.0	1.3	1.0
X-JIGNA (Check2)	0.3	1.7	1.7	1.7
HIBRE (Check3)	0.7	1.0	0.7	1.0
Mean	1.3	1.2	1.5	1.3

LB: leaf blast, PB: panicle blast, BS: brown spot, Phac: phenotypic acceptability

Table 7. Farmers' feedback and ranking of six rice varieties at Fogera and Pawe based on visual observation for selected agronomic traits.

Location	Variety	PH	PL	GD	SF	CC	Mean	Rank
Fogera	KOMBOKA	5	2	3	3	1	2.8	5
	TANZANZANIA Tai	3	1	3	3	1	2.2	4
	TXD 306	3	3	5	3	1	3.0	6
	EDIGET (Check1)	2	2	1	1	1	1.4	2
	X-JIGNA (Check2)	1	1	2	1	1	1.2	1
	HIBRE (Check3)	2	2	1	2	1	1.6	3
Pawe	KOMBOKA	1	1	1	1	1	1.0	1
	TANZANZANIA Tai	1	2	1	1	1	1.2	2
	TXD 306	2	2	3	2	1	2.0	5
	EDIGET (Check1)	1	2	2	1	1	1.4	3

X-JIGNA (Check2)	5	1	1	1	1	1.8	4
HIBRE (Check3)	2	3	3	2	1	2.2	6

PH: plant height, PL: panicle length, GD: growth duration, SF: spikiletes fertility, CC: caryopsis color

4. CONCLUSION AND RECOMMENDATION

Introduction and registration of commercial rice varieties following evaluation for adaptability in major rice growing localities and acceptability by farmers is one option to quickly provide improved and high yielding rice varieties to rice growers and thereby improve production and productivity of the crop. This approach often shortens the traditional way of genotype evaluation and variety release; from observation nursery to variety verification trials which takes no less than six cropping seasons (six years in Ethiopia). In this study, the variety 'KOMBOKA' followed by 'TANZANIA Tai', both of which with long grain size and white caryopsis, were the first and second choices of farmers at Pawe and they also showed good agronomic performance in grain yield, filled grains per panicle, and spikeletes fertility. However, evaluation by national variety release technical committee coupled with farmers' feedback approved 'KOMBOKA' for registration as lowland rice variety for cultivation in Pawe and similar rice production systems of Ethiopia by the common name 'Fogera 2' in 2016. The profile of Fogera 2 also indicated that the variety can be cultivated relatively in low elevation areas other than Pawe that receive high amount of rainfall and have high temperature and relative humidity. Fogera 2 is short in plant height and thus it is suggested for private rice investors that can afford to apply high level of fertilizer inputs to this input responsive variety to maximize yield per unit area. The variety has also long grain size of white caryopsis color which is important market trait for investors. Both Fogera 2 and 'TANZANIA Tai' can also be used in cross breeding program to improve other varieties. Moreover, National rice research program in Ethiopia should take into account of farmers' choice of varieties based on their locally set selection criteria.

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