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Women's Participation Status and Constraints in Rice Production in Fogera District of Northwest Ethiopia

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Abstract: this study was conducted in Fogera district, where rice is a means of livelihood, South Gondar Zone, Ethiopia. A total sample of 197 women farmer respondents was selected by using Yemane's formula. A purposive and simple random sampling method was applied. Both qualitative and quantitative research techniques were used. The data were analyzed by descriptive statistics, inferential statistics, participation index and Garrett's problem ranking method. The results showed that age, education level, marital status, credit service, distance to rice main market and use of extension service were significantly associated with women participation in rice production. Moreover, the participation index result indicated that women were actively participated in all activities except plowing of land. However, they participate by confronting many constraints. According to Garrett's problem ranking method, the present research result indicated that fertilizer shortages, floods and weeds were the major constraints for rice-producing female farmers. Hence, we recommend that women should be acknowledged for their active participation in each activities of rice production and invite them in any rice development plat form as one main actor. Furthermore, provide fertilizer on appropriate time, deliver extension and affordable collateral credit service for women farmers to enhance rice production.

Index Terms **- Garret, participation index, rice production, women.**

I. INTRODUCTION

Women make essential contributions to the rural economy especially in developing countries who serve as farmers, laborers and entrepreneurs (SOFA Team and Doss, 2011). Yet, one fact is strikingly consistent across countries that women have less advantage than men benefits from agricultural products. The constraints faced by women farmers who benefit from agricultural products differ from country to country and culture to culture (Kabane, 2010).

In particular, rice is a labor intensive crop that requires women's work from pre harvest to postharvest (World Bank, 2014). Therefore, to improve production and productivity and to meet food demand, women's beneficiaries must be confirmed. Because, as women's income increases, they can contribute to poverty reduction and well-being improvements (Farnworth *et al.*, 2018).

The study area, Fogera district is one of the leading producers of rice in Ethiopia, contributing 58% of Amhara region and 28% of national production (Hagos, 2015). In Fogera district, women contribute most of the labor force in rice production. However, their contributions are not recognized.

In the study area, there is no sufficient research and interventions have been conducted on the status women participation and their constraints in rice production. Hence, this research paper is a pointer to fill the identified gaps. Therefore, this research was conducted to assess the level of women's participation and identify their participation constraints in rice production.

II. RESEARCH METHODOLOGY

2.1. Description of the Study Area

The study was carried out in Fogera district, Amhara National Regional State of Ethiopia, where rice production is dominant in the region as well as in the country. The district town is Woreta (main market), which is located 42 kilometers from Debre Tabor, the capital city of South Gondar zone, and 55 kilometers from Bahir Dar, the capital city of Amhara National Regional

State. The total population of the district is 253,790 and among the total population, approximately 245,830 people live in rural areas (FDARD, 2020). A map of the study area is shown in Fig. 1.

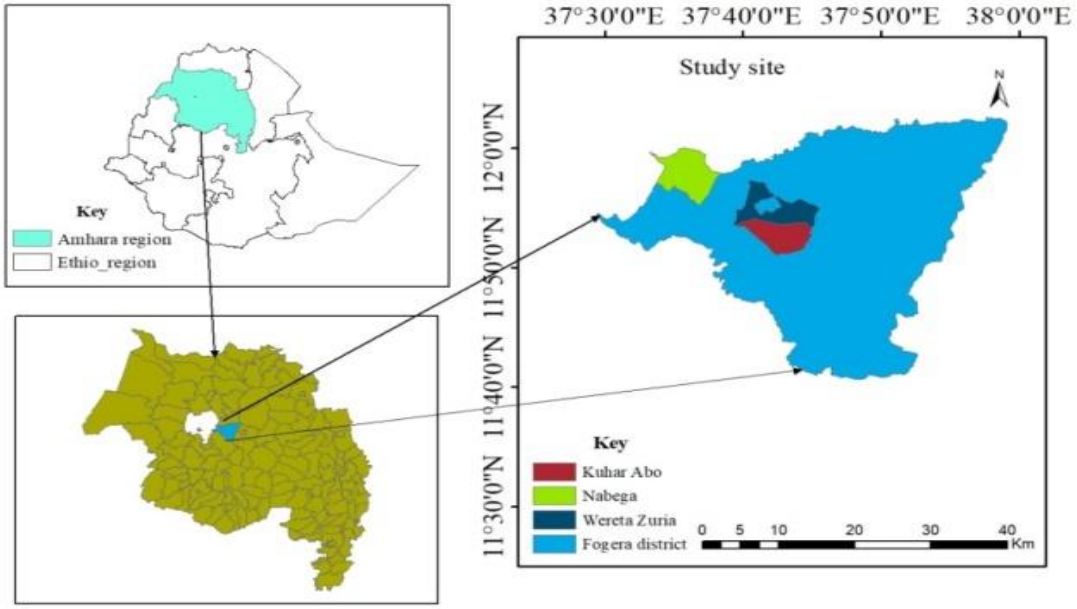


Fig.1. Map of the study area

2.2. Sampling Procedure and Sample Size Determination

To select rice-producing female farmers, a two-stage sampling technique was applied. In the first stage, sixteen "kebeles" were selected purposively because other "kebeles" do not produce rice. In the second stage, three "kebeles" out of sixteen rice-producing "kebeles" were selected via a simple random sampling technique. Similarly, a total of 197 respondents were selected by simple random sampling. Finally, the number of sample respondents in each selected "kebel" was taken proportionally to the respective population (Table 1). The sample of respondents was determined by using Yemane's formula as follows: $\boldsymbol{n = \frac{N}{1+N(e^2)}}$ Accordingly, $n = \frac{5448}{1+5448(0.07^2)} = 197$ where n = sample size, N = population, 1 = a constant and "e" = precision level, which is 0.07 because the population in the study area is relatively homogeneous in terms of socioeconomic status and is valid at 93% confidence level. In the study area, the total number of rice-producing farmer households for the three "kebeles" was 5448. The three "kebels", for which samples were collected, were Kuhar Abo, Woreta Zuria and Nabega, with 26, 59 and 112 respondents, respectively (Table 1).

Table 1. Sample size and their proportion of three kebeles

Kebeles	No. rice producer	Number of selected samples	Proportion (%)
Kuhar Abo	722	26	13.2%
Woreta Zuria	1626	59	29.8%
Nabega	3100	112	57%
Total	*5448*	*197*	*100%*

2.3. Research Design

This study included both quantitative and qualitative research techniques. These techniques were designed to complement each other and are important for triangulating the data. A cross-sectional survey was carried out to convey quantitative and qualitative data. Moreover, the summary of explanatory variables are presented in Table 2.

Table 2. Summary of explanatory variables

Variable type	Variable name	Variable type	Measurement	Expected sign
Dependent variable	Women participation	Categorical	Low, medium and high	
	Age of respondent	Categorical	>30,30 to 45 and < 45	(-)
	Rice farming experience	Continuous	Number	(+)
	Education level	Categorical	Un/able to read and write, grade 1-4, grade 5-8, and above grade 8	(+)
	Farm size of the household	Continuous	Hectare	(+)
	marital status	Categorical	Single, married, divorced and widowed	(+)

Independent variables	Distance to nearest rice main market	Continuous	Kilometer	(-)
	Distance to research center	Continuous	Kilometer	(-)
	Distance to FTC	Continuous	Kilometer	(-)
	Access to Extension Services	Dummy	Accessed or not	(±)
	Access to credit service	Dummy	Credit use or not	(±)
	Member of cooperatives	Dummy	Member or not	(±)

2.4. Method of Data Collection

Structured questionnaire-based interviews and focus group discussions were used to collect the data. The questionnaire was designed with Cspro software version 7.2 and Amharic language was used. Both primary and secondary sources of data were used. Primary data were collected from women rice producer farmers and secondary data were taken from the Fogera agricultural office.

2.5. Methods of Data Analysis

2.5.1. Descriptive and inferential analysis

Descriptive statistics such as mean, percentage, frequency and standard deviation was used. Additionally, Pearson correlation and ANOVA test was applied for continuous variable and chi square test for discrete variables was used to test the relationship and/or dependency between women participation and the independent variables.

2.5.2. Women participation index

The level of woman participation in rice production was measured by putting the indicator activities with their score value of frequencies. The score value of frequencies was frequently (3), occasionally (2), seldom (1) and never (0). The frequency counts of responses were used to compute the participation index (PI) of woman for each selected activities. Then participation index for each individual activity has been computed by using the following formula: $PI= (N_0*0) + (N_1*1) + (N_2*2) + (N_3*3)$; Where: PI= Participation index for different activities of women participation in the rice production and marketing; N_0 = Number of women who never participate; N_2 = Number of women who seldom participate; N_3 =Number of women who occasionally participate and N_4 =Number of women who frequently participate. Class interval = $\frac{\text{highest score value} - \text{lowest score value}}{\text{required class}}$. The participation indexes described above expresses to what extent women are involved in each activity were calculated for each respondent and then convert in to women participation index with the same procedure. The required class was three (low, medium and high) (Leza and Matewos, 2017; Yimer and Giziew, 2019).

2.5.3. Garrett's Ranking Technique

Garrett's ranking technique was used to analyze the data. This problem ranking method was formulated by Garrett and Woodworth (1969). This technique is important for arranging constraints based on respondents' points of view by prioritizing constraints from highest to lowest. Researchers, such as Jimjel *et al.* (2015), Dhanavandan (2016), and Ao and Jamir (2020), have applied Garrett's problem ranking technique and prioritized problems. To calculate Garret's score, first calculate the percent position value as follows: Percent Position = $(100(R_{ij} - 0.5)/N_j$, where R_{ij} is the rank given for the i^{th} constraint by the j^{th} individual/respondent and N_j is the number of constraints ranked by the j^{th} individual/respondent. Second, the total Garret score for each constraint was calculated by the summation of the number of respondents for a given rank constraint multiplied by Garrett's score. Third, the mean Garrett score for each constraint was calculated as the total Garret score for each constraint divided by the number of respondent women (19). Finally, based on Garret's score, constraints were ordered from largest to smallest (descending order), and the first rank of constraints started from the largest value. For the conversion of the Garret problem rankings, Garret's table was used (Appendix Table 1).

III. Results and Discussion

3.1. Characteristics of Demographic and Socio-Economic Factors

Age of respondents for women farmers: As indicated in Table 3 among 197 respondents 9.6% were young, 59.9% were medium and 30.5% were old ages. This implies that about 69.5% of the study area respondents were active age. The association between age of respondents and women farmers participation in rice production were statistically highly significant at less than 1% ($\chi 2 = 83.81$ and $p = 0.000$). This result is in line with Roy (2015) reported that age had positive and significant effect on women participation. High level of women participation was scored for medium age respondents followed by young and old age categories. This was supported by Randela *et al.* (2008) reported that younger women farmers were more progressive and friendly new ideas for agricultural production and productivity.

Table 3. Age of respondent's

Variable	Categories of variables	Level of women participation						Subtotal N	Total (197) %	χ^2 value	P Value
		Low		Medium		High					
		N	%	N	%	N	%				
Age of respondents	Below 30	0	0.0	6	31.6	13	68.4	19	9.6	83.81	0.000
	30 to 45	1	0.8	8	6.8	109	92.4	118	59.9		
	Above 45	2	3.3	21	35.0	37	61.7	60	30.5		

Note: The three levels of women participation percentage were calculated from the sub total of each category of variables. This is applied for other variables too.

Source: extracted from own survey data

Education level of respondents for women farmers: Out of 197 respondents, 63.5% were unable to read and write, 20.8% could read and write, 11.2% were grade 1 up to 4 and 4.6 % were grade 5 up to 8; *i.e.*, all respondents education level was below grade 8 (Table 4). This indicated that more than half of uneducated rural women were much involved in rice production and marketing. The association between education level and women participation was statistically highly significant ($\chi2 = 100.56$ and P=0.001) (Table 4). This is contradicted with Farid *et al. (*2009) report that education level had insignificant association with rural women's participation in rice farming activities. The level of women participation in rice production indicated that as education level increases women participation also increases (Table 4). This supported by Jaleta *et al.*, 2009 better educated women could have relatively better motivation for income generating activities.

Marital status of women farmers: Out of the 197 interviewed women farmers the highest proportion was married (86.3%) and followed by divorced (8.2%), widowed (4.6%) and single (0.5%). The association between marital status and women participation was statistically highly significant at <1% ($\chi2$= 155.12 and p-value=0.000) in rice production activities. The level of women participation in rice production activities showed that single women had better participation level than married, divorced and widowed women (Table 4). This might be single women were less bourdon in reproductive role. This result was contradicted with Firafis (2016) report that single household's contribution was less than married households in agricultural production.

Table 4. Education level and marital status of respondent's

Variable	Category of variable	Level of Participation						Subtotal N	Total (197) %	χ^2 value	P Value
		Low		Medium		High					
		N	%	N	%	N	%				
Education level of household head	Unable to read and write	3	2.4	26	20.6	97	77.0	126	64.0	100.6	0.001
	Able to read and write	0	0.0	8	20.0	32	80.0	40	20.3		
	Grade 1 to 4	0	0.0	1	4. 6	21	95.5	22	11.2		
	Grade 5 to 8	0	0.0	0	0.0	9	100.0	9	4. 6		
	Above grade 8	0	0.0	0	0.0	0	0.0	0	0.0		
Marital status of household head	Single	0	0.0	0	0.0	1	100.0	1	0.5	155.1	0.000
	Married	1	0. 6	25	14.6	145	84.8	171	86.8		
	Divorced	1	6.3	5	31.3	9	56.25	16	8.1		
	Widow	1	11.1	4	44.4	4	44.4	9	4. 6		

Source: Computed from own survey data

Rice farming experience of women farmers: As showed in Table 5, the minimum and maximum exposure of households in rice farming ranged from 1-40 years with a mean of 15.98 years. The correlation between rice farming experience and level of women farmers participation was statistically negative and insignificant (r= -0.01 and p=0.91). The level of women farmer participation indicated that when rice farming experience increases their participation becomes decreased. This might be related with age and their working hour. This result was contradicted with Martey *et al.* (2014) report, which as farmers got more experience the level of participation in rice farming activities became higher. The one-way ANOVA test indicates highly significant mean difference among the different participation groups at <1% level of significant (F=3.04 and P=0.000).

Rice land size of women farmers: As indicated in Table 5, the maximum, minimum and the mean value of rice land size of women farmers were 1.5, 0.1 and 0.53 ha; respectively. The correlation between rice land size and women farmers participation in rice production was statistically negative and insignificant (r= -0.01 and p= 0.09). The one-way ANOVA test shows that significant mean difference at < 5% in the different participation categories (F=1.93 and P=0,004). The level of participation showed that when women that have high rice land size their participation also increased. So, the result strongly supports the hypothesis.

Table 5. Rice farming experience and rice land size

Variable	Mean of participation categories Low (3)	Mediu m (35)	High (159)	Min value	Max value	Mean value	Std. Deviation	F	P-Value	R	P Value
RFE	24	15.34	15.97	1	40	16	5.98	3.04	0.000	-0.01	0.910
RLSIZE	0 .29	0.47	0.54	0.1	1.5	0.53	0.31	1.93	0.043	0.211	0.09

Where RFE = Rice farming experience and RLSIZE = Rice land size
Source: Computed from own survey data

3.2. Characteristics of Institutional and Market Factors

Use of agricultural extension service: As showed in Table 6, 73.1% of respondents were that access to extension service in rice production in 2021/22. The association between accesses to agricultural extension service and women participation was statistically highly significant at less than 1% ($\chi 2$=49.2 and P =0.00). This result was supported by Tiruneh *et al*. (2001). The level of women participation indicated that women's that have accesses to extension service their participation became high.

Credit service use: As Table 6, revealed that 52.3% had used credit service whereas 47.7% not used. The association between credit service use and level of women participation in rice production was statistically significant for ($\chi 2$ = 55.2 and P= 0.000). The result supported by Hirpo (2010) women participation and access to credit service was significant association.

Member of farmers' cooperative: As indicated in Table 6, 67.5% of women are being a member of cooperatives while, 32.5% of women were not a member of cooperatives. The association between member of farmers' cooperative and level of women participation in rice production was highly significant for ($\chi 2$=43.1 and p=0.002). Similarly, the level of women participation indicated that being a member of farmers' cooperative were in high participation category than non-part.

Table 6. Extension service use, credit service and member of farmers' cooperatives

Variable	Category of variables	Level of Participation						**Sub total N**	**Total %**	$\chi 2$ – value	P – Value
		Low		Medium		High					
		N	%	N	%	N	%				
Extension services use	Yes	0	0.0	18	12.5	126	87.5	144	73.1	49.2	0.000
	No	3	5.7	17	32.0	33	62.3	53	26.9		
Credit use	Yes	0	0.0	13	12.6	90	87.4	103	52.3	55.2	0.000
	No	3	3.2	22	23.4	69	73.4	94	47.7		
Member of farmers' cooperative	Yes	0	0.0	17		116		133	67.5	43.1	0.002
	No	3	4.7	18	28.1	43	67.2	64	32.5		

Source: Computed from own survey data

Distance to rice main market: As indicated in Table 7, the minimum and maximum distance travel was ranged from 0.1 to 23 km with mean of 6.52 and standard deviation of 6.64. The correlation indicated that statistically negative and significant relationship between market distance and women participation in rice production (r = - 0.273 and P= 0.000). That implies that as market distance decreased, the level of women participation increased participation in rice production low (7.06), medium (4.47) and high (2.17) (Table 7). The one-way ANOVA test showed that significant mean difference among three level of participation categories (F=3.57 and P=0.000).

Distance to research center: The minimum and maximum distance travel was ranged from 6.0 to 21.0 km with mean of 12.01 and standard deviation of 7.00. The correlation between distance to research center and women participation in rice production was statistically insignificant (r=-0.14 and p=0.110) (Table 7). The one-way ANOVA test showed significant mean difference with in three level of participation group (F=5.57 and P=0.000).

Table 7. Distance to farmer training center, distance to research center and distance to rice main market

Variable	Mean of level of women participation categories Low (3)	Medium (35)	High (159)	Min value	Max value	Mean Value	Std. Deviation	F	P Value	R	P Value
DFTC	3.67	2.09	2.04	0.1	0.5	0.5	0.1	5.11	0.000	0.09	0.216

DRC	19	12.84	11.79	6	21	12	7	5.57	0.000	-0.14	0.11
DRMM	7.06	4.47	2.17	1.46	7	6.52	6.67	3.57	0.000	-0.27	0.000

Where, DFTC = Distance to Farmer Training Center, DRC = Distance to Research Center and DRMM = Distance to Rice Main Market

Source: Computed from own survey data

3.3. Level of Women Farmer Participation in Rice Production

Women farmers' participation index indicator of major activities for rice production were seed cleaning and soaking, land cleaning and bunding, plowing, row planting, fertilizer application, transplanting, weeding, harvesting, drying, threshing, transporting, storage preparation and selling. The class interval was calculated by using the difference of maximum score value and mini mum score value of women farmers' participation indicator activities divided by three classes (low, medium and high). That is class interval = (Table 8). Accordingly, the level of women participation for each participation indicator activities score value was classified as low from 0-196, medium from 197-394 and high from 394-591. Hence, based on each activity score value plowing and row planting was low for women farmers' participation. The other participation indicator activities such transplanting, land preparation (bunding), fertilizer application, and transporting were medium for women farmers' participation. The remaining participation indicator activities such as seed cleaning and soaking, storage preparation, selling and food preparation, weeding, trashing and drying were high for women farmers' participation. Most of activities were in line with Yimer and Giziew (2019) storage preparation, weeding, threshing and row planting were categorized in high participation.

Table 8, Level of women participation in rice production

	Level of women participation in	Frequently (3)		Occasional (2)		Seldom (1)		Never (0)		NA		Total		Score value
		N	%	N	%	N	%	N	%	N	%	N	%	
1	Seed cleaning and soaking	185	93.91	10	5.08	2	0.01	0	0.00	0	0.00	197	100	577
2	Land preparation	22	11.17	121	61.42	25	0.13	29	14.72	0	0.00	197	100	333
3	Plowing	0	0.00	0	0.00	0	0.00	197	100.0	0	0.00	197	100	0
4	Row planting	33	16.75	28	14.21	19	0.10	21	10.66	96	48.73	197	100	174
5	Fertilizer application	48	24.37	29	14.72	49	0.25	71	36.04	0	0.00	197	100	251
6	Transplanting	37	18.78	76	38.58	11	0.06	19	9.64	54	27.41	197	100	274
7	Weeding	160	81.22	20	10.15	9	0.05	8	4.06	0	0.00	197	100	529
8	Harvesting and drying	101	51.27	44	22.34	30	0.15	22	11.17	0	0.00	197	100	421
9	Threshing	96	48.73	68	34.52	20	0.10	13	6.60	0	0.00	197	100	444
10	Transporting	80	40.61	53	26.90	35	0.18	29	14.72	0	0.00	197	100	381
12	Storage preparation	150	76.14	28	22.00	15	0.08	4	2.03	0	0.00	197	100	521
13	Selling	163	82.74	24	14.00	4	0.02	4	2.03	2	1.02	197	100	541
14	Food preparation	197	100.0	0	0.00	0	0.00	0	0.00	0	0.00	197	100	591

Source: Computed from own survey data

Constraints of rice-producing women farmers: The total number of constraints for women farmers in rice production was 16, and these constraints were converted into Garret's problem ranking score (Table 9). Accordingly, fertilizer shortages, floods and weeds were the major constraints on women farmers' participation in rice production, with mean Garrett scores of 79.2, 73.3 and 65.90, respectively (Table 10).

Fertilizer shortage: This is the first constraint faced by women rice-producing farmers (Table 10).The qualitative data obtained through focus group discussion also support this result. The reason behind is the unfair distribution of fertilizer. The development agents first provide opportunities for their close friends, relatives, and model male farmers. In addition, there is a lack of information on the distribution of fertilizer. Similarly, Ullah *et al.* (2019) reported that women faced sociocultural problems such as salary dissatisfaction and a lack of chemical and fertilizer access. On the other hand, the FAO (2011) reported that if women had the same access to productive agricultural inputs as men, their yields could increase by 20–30%.

Flooding: As indicated in Table 9, flooding was the second major constraint on rice production for women farmers. The qualitative results also confirmed that flooding was the major problem. When the level of rain was high and continued, the overflowing of the ''Erib'' and ''Gumara'' Rivers could damage rice production. Correspondingly, APRA (2020) reported that flooding is expected and an opportunity for typical lowland rice production, whereas it becomes a constraint when the level of flooding is above the rice plant height for more than two weeks.

Weed: Weed was the third major challenge for women in rice production (Table 9). In the study area, people still use traditional hand weeding. This traditional method of rice weed control is labor demanding and tiresome. The focus group discussion also supported that weed control costs were high. Sometimes to escape unaffordable weed costs, women share out their rice lands for men farmers. Similarly, Harsch (2004) reported that African women spent 40-60% of the total labor input for rice production on weeding.

Table 9. Percent position and garret value

Rank	Percent position	Garret Score	Rank	Percent position	Garret Score
1	3.13	86	9	53.13	48
2	9.38	76	10	59.38	45
3	15.63	70	11	65.63	42
4	21.88	65	12	71.88	39
5	28.13	61	13	78.13	35
6	34.38	58	14	84.38	30
7	40.63	55	15	90.63	24
8	46.88	52	16	96.88	14

Source: Computed from own survey data

Table 10. Constraints faced by women farmers in rice production

RP	OXS	INS	DI	DRT	WD	FLD	FRS	SDS	LOP	FRS	LAS	LOC	LOS	LOI	TFT	SOL
1	10	0	1	4	5	97	1	4	1	93	2	6	2	0	4	14
2	11	2	7	24	33	22	3	19	2	83	6	5	1	2	5	14
3	22	0	23	1	83	18	0	4	7	5	7	7	0	2	0	25
4	25	4	23	12	20	7	0	18	1	7	11	26	0	14	1	25
5	46	3	15	2	15	7	2	8	0	3	12	17	3	3	0	56
6	47	1	16	10	6	6	1	17	0	1	14	28	3	2	15	23
7	3	13	3	3	9	2	13	53	1	1	27	36	5	2	16	11
8	1	0	12	31	11	16	25	9	10	2	1	28	4	3	34	5
9	7	7	7	16	5	12	32	35	3	0	25	20	1	8	8	8
10	17	6	39	23	2	8	42	5	3	2	1	12	15	1	9	8
11	3	45	29	15	3	0	4	17	11	0	19	9	13	10	15	1
12	5	24	14	6	0	1	18	4	14	0	26	1	32	26	28	2
13	0	53	0	4	3	0	8	2	38	0	14	0	21	10	37	5
14	0	19	6	15	1	1	7	2	45	0	25	1	27	7	22	0
15	0	18	2	30	0	0	16	0	9	0	6	0	52	41	1	0
16	0	2	0	1	1	0	25	0	52	0	1	1	18	66	2	0
TR	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197
TG	1203	7685	1043	9488	1298	1445	8029	1100	6279	1560	9369	1113	6650	6098	8825	1229
MG	61.1	39	52.1	48.2	65.9	73.4	40.8	55.8	31.9	79.2	47.6	56.52	33.8	30.9	44.8	62.4
RG	5th	13th	8th	9th	3rd	2nd	12th	7th	15th	1st	10th	6th	14th	16th	11th	4th

RP = ranking problem of women farmers, OXS= Oxen shortage, INS=Insects, DI=Diseases, DRT=Drought, WD=Weeds, FLD=Flood, FRO=Frost, SDS=Seed shortage, LOP=Lack of pesticide, FRS= Fertilizer shortage, LAS= Labor shortage, LOC=lack of capital, LOS=lack of skill, LOI=lack of information, TFT=Theft, SOL=Shortage of land, TR = Total No of respondent, TG = Total Garret's score in each constraint, MG = Mean of Garret's score in each constraint and RG = Rank-based Garret's value

Source: Computed from own survey data

IV. CONCLUSIONS AND RECOMMENDATIONS

Rice is the major crop in the study area, and women contribute a leading share in rice production. The result of the research indicated that age, education level, marital status, credit service, distance to rice main market and use of extension service were significantly associated with women participation in rice production. Moreover, the participation index result indicated that

women were actively participated in all activities except plowing of land. However, they participate by confronting many constraints. According to Garrett's problem ranking method, the present research result indicated that fertilizer shortages, floods and weeds were the major constraints for rice-producing female farmers.

Hence, we recommend that women should be acknowledged for their active participation in each activities of rice production and invite them in any rice development plat form as one main actor. Furthermore, provide fertilizer on appropriate time, deliver extension and affordable collateral credit service for women farmers to enhance rice production. Further work is required for women farmers' participation in rice marketing aspect.

AUTHOR CONTRIBUTION STATEMENT

Seged Aychew initiated the research, organized, analyses, and interpreted the data and wrote the manuscript. Dr. Almaz Giziew supervised the research and edited the manuscript. Mr. Assaye Berie organized the data and edited the manuscript.

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CONFLICT OF INTEREST

The authors declare no competing interests.

REFERENCES

[1] APRA (2020). Devastating effect of flood on rice production and commercialization in the Fogera plain. Available at: https://www.future-agricultures.org/page/8.
[2] Ao W, Jamir BK (2020). Application of garret ranking technique in studying the problems of bamboo cultivation: A case Study of Mokokchung district, Nagaland. Indian Journal of Hill Farming, 33:311-315.
[3] Dhanavandan S (2016). Application of garret ranking technique practical approach that faced problems by researchers. Vol. 6(3), ISSN: 2231-4911.
[4] FAO (Food and Agriculture Organization of the United Nations) (2011). The State of Food and Agriculture 2010–2011. Women in Agriculture. Closing the Gender Gap for Development. Rome.
[5] FDARD (Fogera District Agriculture and Rural Development) (2020). Quarter report prepared to South Gonder Zone.
[6] Farnworth C, Stirling R, Chinyophiro A, Namakhoma A, Morahan R (2018). Exploring the Potential of Household Methodologies to Strengthen Gender Equality and Improve Smallholder Livelihoods: Research in Malawi in Maize-Based Systems. Journal of Arid Environments, 149: 53–61.
[7] Farid KS, Mozumdar L, Kabir MS, Goswami UK. 2009. Nature and extent of rural women's participation in agricultural and non-agricultural activities. Agricultural Science Digest, 29(4):254– 259.
[8] Firafis (2016). Factors affecting women farmers' participation in agricultural extension services for improving the production in rural District of Dendi West Shoa Zone, Ethiopia.
[9] Garret HE, Woodworth RS (1969). Statistics in Psychology and Education. Vakils, Feffer and Simons Pvt. Ltd., Bombay. P-329.
[10] Hagos A (2015). Determinants of Improved Rice Varieties Adoption in Fogera District of Ethiopia, Jornal of Science, Technology and Arts Research, pp. 221-228.
[11] Harsch E (2004). Farmers embrace African 'miracle' rice: high-yielding'Nerica' varieties to combat hunger and rural poverty. Africa Recovery, 17(4):10.
[12] Hirpo R (2010). Determinants of Rural women empowerment. Positive case of help development credit services, in Haramaya District, East Hararge Zone, Ethiopiap. MSc.Thesis, Hramaya University, Dire Dawa, Ethiopia, p.101.
[13] Jaleta M, Gebremedhin B, Hoekstra D (2009). Smallholder Commercialization: processes, determinants and impact. Discussion paper No. 18: Improving productivity and market success of Ethiopian farmers, improving market opportunities, International Livestock Research Institute, Nairobi
[14] Jimjel Z, Rakesh S, Madhusudan B, Singh OP, Dayakar R (2015). Analysis of Constraints Influencing Sorghum Farmers Using Garrett's Ranking Technique; A Comparative Study of India and Nigeria. International Journal of scientific research and management, 3:2435-2440.
[15] Kabane N (2010). Being short changed: women and access to land in patriarchal societies. Available from:http://www.afesis.org.za/local/governmanance/articles/being-short- changed-women-access- to-land-in-patriarchal-societies.
[16] Leza T, Matewos E (2017). Determinants of rural women's decision in participation of microfinance services in case of omo microfinance in Boloso Bombe district of Wolaita zone, Ethiopia. J. Agric. Eco. pp. 10.
[17] Roy (2015). Women labor participation in rice production in some selected areas of Thakurgaon district, 2: 239-246.
[18] Randela R, Alemu ZG, Groenewald J A (2008). Factors enhancing market participation by small scale farmers. Agrekon, 47(4).
[19] SOFA Team, Doss C (2011). The Role of Women in Agriculture, department of Economics Division. The Food and Agriculture Organization of the United Nations. ESA Working Paper No.11-02 w.fao.org/economic/esa.
[20] Ullah T I, Anwer HN, Sher F, Musa M (2019). Analysis of issues faced by women in farming system of punjab analysis of issues faced by women in farming system of punjab, Pakistan. J agric. res., 57(4):309-314.
[21] World Bank (2014). Africa capitalizing on rice export opportunities, economic and sector work." World Bank report No. 85804. Washington, DC.
[22] Yimer M, Giziew A (2019). Analysis of rural women's Participation in rice Production using ordinal logistic regression model. Journal of Rural Development, 38(2): 234-265.

APPENDIX

Appendix Table 1. Garrets problem ranking conversation

Percent	Score	Percent	Score	Percent	Score
0.09	99	22.32	65	83.31	31
0.20	98	23.88	64	84.56	30
0.32	97	25.48	63	85.75	29
0.45	96	27.15	62	86.89	28
0.61	95	28.86	61	87.96	27
0.78	94	30.61	60	88.97	26

0.97	93	32.42	59	89.94	25
1.18	92	34.25	58	90.83	24
1.42	91	36.15	57	91.67	23
1.68	90	38.06	56	92.45	22
1.96	89	40.1	55	93.19	21
2.28	88	41.97	54	93.86	20
2.69	87	43.97	53	94.49	19
3.01	86	45.97	52	95.08	18
3.43	85	47.98	51	95.62	17
3.89	84	50.00	50	96.11	16
4.38	83	52.02	49	96.57	15
4.92	82	54.03	48	96.99	14
5.51	81	56.03	47	97.37	13
6.14	80	58.03	46	97.72	12
6.81	79	59.99	45	98.04	11
7.55	78	61.94	44	98.32	10
8.33	77	63.85	43	98.58	9
9.17	76	65.75	42	98.82	8
10.06	75	67.48	41	99.03	7
11.03	74	69.39	40	99.22	6
12.04	73	71.14	39	99.39	5
13.11	72	72.85	38	99.55	4
14.25	71	74.52	37	99.68	3
15.44	70	76.12	36	99.80	2
16.69	69	77.68	35	99.91	1
18.01	68	79.17	34	100.00	0
19.39	67	80.61	33		
20.93	66	81.99	32		