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Assessment of Adaptability of Some Rice Landraces (*Oryza sativa* L.) of West Bengal for Drought Tolerance

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ABSTRACT

Drought is the most widespread and damaging of all environmental stresses, affecting 23 million hectors of rainfed rice in South and Southeast Asia, including India. In some states in India severe drought can cause as much as 40% yield loss. Present investigation was aim to screening and identification of drought tolerant traditional varieties still exists in various rice cultivation region of West Bengal. 50 different traditional rice varieties had been collected from throughout the West Bengal and these were screened for drought tolerant potentiality in ex-situ conditions. Growth performance of various traditional varieties were examined in two different condition, drought condition with lower water and nutrient supply (Greenhouse screening) and normal condition (both rain fed and well irrigated condition) in 'Kharif' season (Jun, July to November, December) of 2017-18 session. From the drought tolerant study, it was observed that variety Bhadoi, Kelesh, Vutmuri, Baskata, and Verisal were able to regain stem length compared to the control condition after the drought period. These varieties have potentiality of tolerance by surviving in the drought duration and these varieties will be the better choice for the cultivation at the drought effected region of West Bengal particularly in the Bankura and Pururial district. This varieties may plays a vital role in sustainable agriculture in drought prone region of West Bengal.

INTRODUCTION

Drought is a natural climatic condition of several districts of West Bengal. These districts were frequently face drought like condition in an interval of every two or three years. Fluctuating rainfall, with intermittent drought spell between two successive rainfalls, makes the rice cultivation very vulnerable and seriously affects the yield. Rice is the staple food of West Bengal and for the sustainable livelihood, sustainable rice production is the basic necessity [1]. India is a motherland of thousands of ecotypes of rice landraces [2]. Exploitation and adaptability of traditional rice genotypes of rice playing a critical role in production of more improved rice varieties for sustainable agriculture [3] [4]. Due to the overexploitation of modern HYVs, the traditional varieties were gradually decreasing from the agricultural field of the West Bengal [5] [6]. Sinha and Mishra [7-15] had studied conservation of existing traditional rice varieties of West Bengal and their characterization. Present investigation was aim to screening and identification of drought tolerant traditional varieties still exists in various rice cultivation region of West Bengal. Previously Karmakar *et al.* [16] have studied on profiling of selected indigenous rice landraces of Rarh Bengal in relation to osmotic stress tolerance. These varieties may utilized for the sustainable agriculture in the drought effected region of West Bengal particularly in the area of district Bankura and Purulia. Another important aspect is the conservation and protection of these folk varieties from extinction.

MATERIALS AND METHODS

Fifty five traditional rice varieties collected from the various rice growing region of the West Bengal used for the drought potentiality study. The whole experiment was divided into two conditions- stress and non-stress (control) condition. In stress condition, screening of drought tolerant traditional varieties were carried out in greenhouse at farm area of Amarkanan Rural Socio-environmental Welfare Society (ARSWS), of Village Ranbahal of Bankura district of West Bengal (Fig 3), and in another part, same varieties were grown on control condition providing normal water supply (Fig 2). Seeds of various traditional were sown on seedbed after the traditional seed treatment in the month of July of two consecutive Kharif season, 2017 and 2018. Young seedling of 25 to 30 days old were transplanted simultaneously in green house and farm field (Fig 1). In green house, seedlings were planted in plastic pots filled with field soil collected from farm paddy fields up to the depth according to completely randomized block design [17]. Each pot consists of two plants per replicate and in control

condition each entry was sown on 30 rows of 6m length. Row to row and plant to plant distance was 30 cm and 20 cm respectively. Total 60 plants of each varieties were taken for the observation and characterization. Morphological characters like Plant height, and leaf width and agronomic characters like number of reproductive tiller, panicle length and 100 grain weight were taken from the plants grown on both the condition (stress and non-stress). Water is the basic requirement of the normal growth of the rice plant. In green house condition plants were provided normal water supply for first four weeks after transplantation. Supply of water was then discontinue for two weeks. Plants were evaluated for drought resistance by measuring the morphological and agronomic characters of the recovered plants.

Fig 1. Young seedlings of traditional rice varieties in control condition.

Fig 2. Transplantation of the traditional varieties of rice in field with normal irrigation.

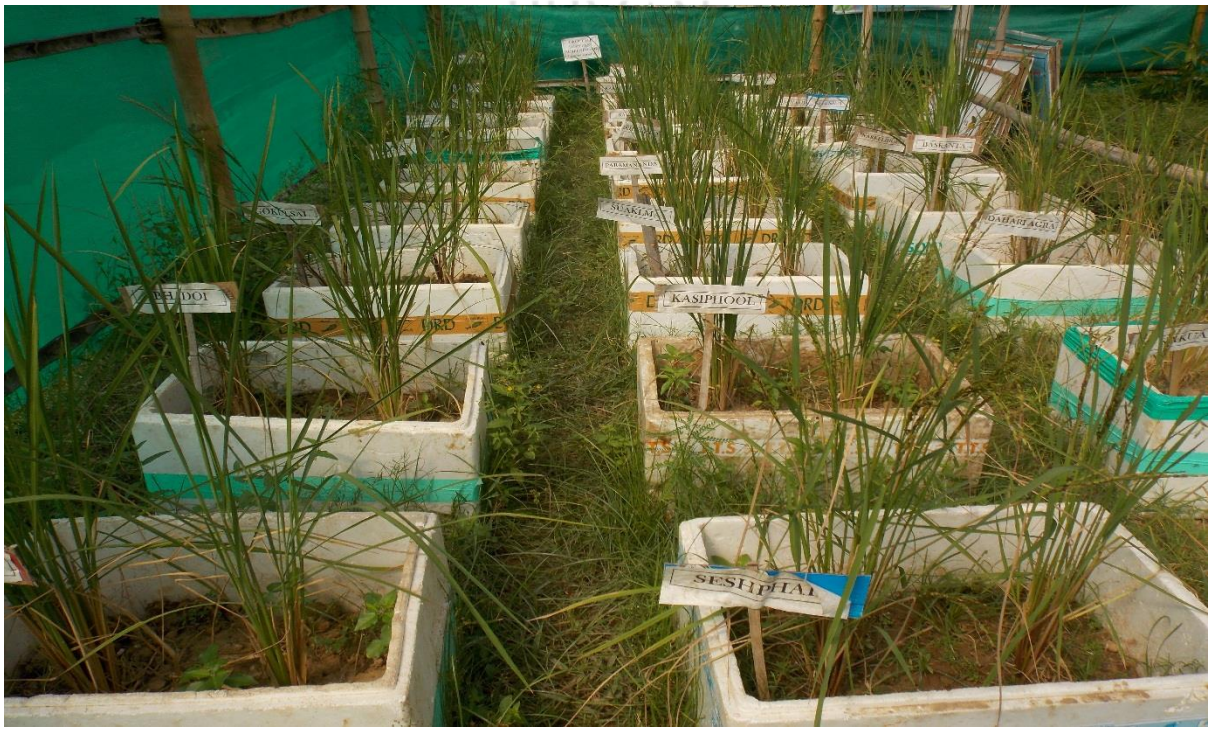

Fig: 3 Green house cultivation of traditional rice varieties in drought stress condition.

RESULTS AND DISCUSSION:

The results showed significant variation with respective morphological and agronomic characters in both the stress and non-stress conditions. List of the traditional varieties and their Comparison of morphological and agronomic characters of 50 traditional rice varieties on both the control (non-stress) and green house (stress) condition are given in Table 1. and the Mean, number, sum, population standard deviation, sample standard deviation, population and sample variance value of agro-morphic characters of plant height, no. of effective tillers and 100 grain weight of 50 landraces of rice varieties were given in Table-2. The shoot length of the traditional varieties ranged from 172 cm to 66 cm in control condition and in stress condition it was varied form 110 cm to 45 cm. Among the studied varieties, Talmugur variety showed highest plant height (172 cm) and variety Vutmuri possess lowest (66cm) in control condition. In drought condition variety Lulisada and Lalkalma possess highest stem length (110 cm) and variety Daharlagra possesses lowest plant height (45cm). Number of reproductive tillers was drastically fall down in drought condition in comparison with the normal condition, majority of cultivars was possesses less than 5 tillers in drought condition. Highest number of effective tiller was found in Malsiraj and Daharlagra variety and it was 25 and lowest number was found on variety Bhadoi and it was only 4 in control condition. Highest number of effective tiller was found on variety Verisal and Asanlya variety and it was only 7 in drought condition.

The 100 seed weight varied from 3.38 gram to 1.7 gram/100 grains cultivated in control condition and it was varied from 2.78 gm to 1.3 gm cultivated in drought condition. Means of shoot length and 100 grain weight were depicted in fig 4 and fig 5.

From the drought tolerant study, it was observed that Variety Bhadoi, Kelesh, Vutmuri Baskata, and Verisal were able to regain stem length compared to the control condition after the drought period. These varieties have potentiality of tolerance by surviving in the drought duration and these varieties will be the better choice for the cultivation at the drought effected region of West Bengal particularly in the Bankura and Pururial district. Many worker had studied impact of drought on morho-physiological traits of rice and reported the same results. Munasinghe *et al* [18] had worked on agromorphic and molecular characterization of 24 Sri Lankan traditional rice on drought stress and observed that some variety have the potentiality to regain the normal growth on post drought period. So many traditional variety can

withstand the various abiotic stress condition and have their yield stability [19] [20]. So sustainable agriculture is depends on the variability of genetic resources.

Table 1. List of the traditional varieties and their Comparison of morphological and agronomic characters of 50 traditional rice varieties on both the control (non-stress) and green house (stress) condition.

Name	Plant Height (cm)		No. of Tiller				100 grain wt. (gm)	
	Control	Drought	Drought		Control		Control	Drought
			Tiller	Effective	Tiller no	Effective		
Aswinsal	102	79	3	2	12	12	2.06	2.0
Agniban	123	66	3	3	8	8	2.08	2.01
Anjali	108	89	4	2	22	22	2.75	2.22
Ashinlaya	84	74	7	7	22	22	2.4	2.0
Badamidhan	130	90	3	3	11	11	2.0	1.8
Bachi	158	65	4	4	13	13	2.33	1.93
Baspati	80	64	4	4	11	11	2.16	1.76
Bahurupi	126	104	3	2	14	14	2.57	1.95
Barani	125	94	2	2	14	14	2.07	1.7
Baskata	96	82	3	3	14	14	2.58	1.9
Bhadoi	72	69	3	3	4	4	2.41	1.94
Bhramarmali	102	62	3	3	13	13	2.15	1.56
Chotodidi	167	70	4	3	12	12	2.19	1.66
Daharlagra	92	45	4	4	25	25	1.91	1.31
Dharansal	161	84	5	3	24	24	2.24	1.78
Jamainadu	146	50	5	5	9	9	2.35	1.88
Jhulur	106	74	5	2	14	14	2.32	1.95
Kaksal	137	79	4	3	14	14	3.03	2.77
Kalodhopa	114	58	2	2	20	20	2.23	1.93
Kelesh	91	63	6	6	8	8	1.97	1.87
Kerala sundari	95	88	2	2	12	12	2.18	1.8
Lalkamal	125	92	5	4	18	18	2.25	1.9
Lulisada	129	110	2	2	10	10	2.84	1.74
Lalkalma	130	110	3	2	8	8	1.85	1.5
Lakkansal	138	60	3	3	13	13	3.38	2.78
Latisal	88	70	3	3	14	14	2.52	2.12
Majsiraj	127	83	3	3	25	25	2.3	2.0
Marichsal	152	101	4	4	9	9	2.13	1.73
Mukta	83	54	4	4	12	12	2.36	1.96
Kalma	78	71	4	2	19	19	2.5	2.0

Neta	98	80	2	2	18	18	2.05	1.77
Nirjhara	82	50	3	3	14	14	2.34	2.04
Niroja	83	69	5	4	14	14	2.33	1.93
Nugembaro	146	52	4	4	14	14	2.61	2.01
Panati	126	53	3	3	14	14	2.26	1.86
Pankhiraj	139	100	4	4	15	15	2.98	2.38
Patnai-23	156	84	3	3	14	14	2.76	2.26
Ragusal	123	70	3	3	12	12	2.45	2.05
Rupsal	161	84	3	3	9	9	2.27	1.97
Seshphal	94	50	3	3	18	18	1.8	1.56
Shiuli	130	81	3	2	10	10	2.63	2.03
Sitapi	122	70	3	3	22	22	2.29	1.89
Sundari	100	76	3	3	11	11	1.7	1.3
Talmughr	172	69	3	3	12	12	3.25	2.77
Velchi	115	70	3	3	18	18	2.36	1.96
Vherisal	79	77	7	7	11	11	1.82	1.52
Valki	94	70	5	5	12	12	2.71	1.91
Vutmuri	66	63	5	5	6	6	2.04	1.84

* The mean values of each variety follow standard deviation and statistically significant difference at the level of $p \leq 0.05$.

Table 2: Mean, number, sum, population standard deviation, sample standard deviation, population and sample variance value of agro-morphic characters of plant height, no. of effective tillers and 100 grain weight of 50 landraces of rice varieties of West Bengal

Characters	Mean average (μ)	Sum	Standard deviation (σ)	Variance (σ^2)	N	Standard deviation (s)	Variance (s^2)
Plant height	115.6	5551	27.72	786.8	50	28.02	785.25
Effective tiller	3.29	158	1.20	1.45	50	1.21	1.48
100 grain wt.	2.34	112.76	0.35	0.12	50	0.36	0.13

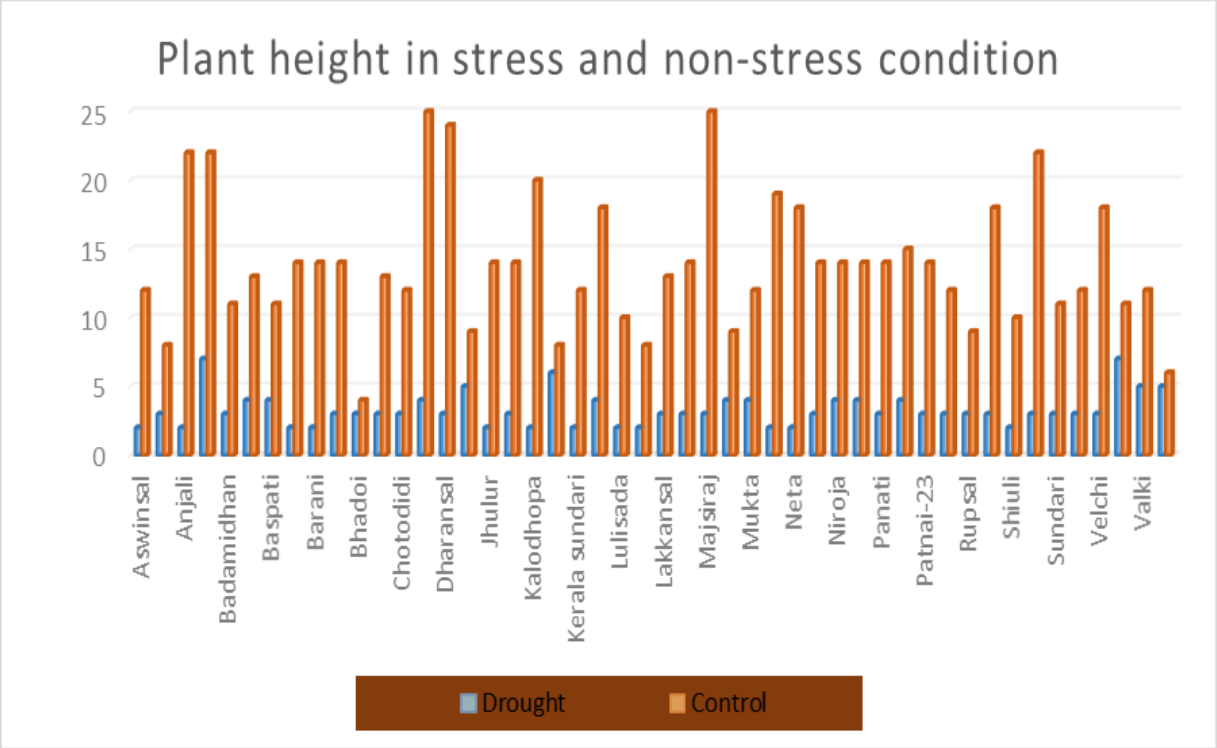

Fig 4: Means of shoot length in different traditional varieties in control and stress condition.

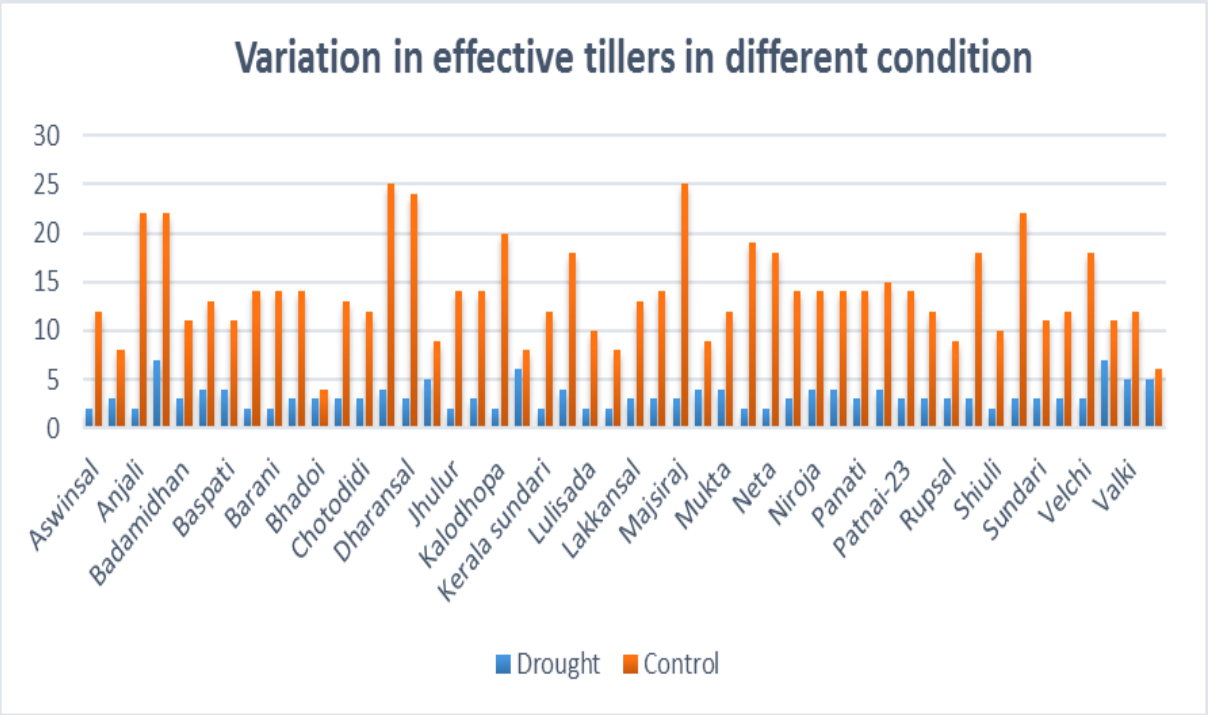

Fig 5: Means of effective tillers different traditional varieties in control and stress condition.

CONCLUSION

Tradition rice varieties my play a vital role in sustainable agriculture. In present era of climate change, the modern varieties has failed to perform the best and we have to developed more improved variety in near future to fulfil the increasing demands of food grin and for that we have to protect and restore our genetic diversity present in the form of landraces.

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