



CONSERVATION AND AGRO-BOTANICAL CHARACTERIZATION OF SOME FOLK RICES (*Oryza sativa* L.) OF WEST BENGAL

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Received: 21.04.2022; Accepted: 03.06.2022; Published Online: 30.06.2022

Abstract

Agriculture in West Bengal is the means of livelihood of about 65% of the population of the state mostly living in villages. Rice is the staple food grain in West Bengal. Rice occupied almost 53% of the total agricultural crop areas of the state of West Bengal during 2007-08 and it contributed the same percentage (53%) towards the total production of all agricultural crops during the same period. India being the birth place of rice can boast of more than 88,000 varieties of rice. But unfortunately more than 90% of rice field is under cultivation of 10-15 'high yielding varieties' only. The situation is fast eroding the very old traditional landraces (henceforth called 'folk varieties') of rice. Another serious factor is changing climatic condition which adversely affects the maturation and reproductive cycle of plants. Keeping the severity of situation an attempt is being made to conserve the existing indigenous folk rice varieties which are gradually disappearing from the farmers' fields of West Bengal. In this work on-farm cultivation and conservation of more than 130 folk varieties of rice have been executed and is being tried to multiply and restored on small farm areas. This work also deals with agro-botanical characterization like grain characters (grain length, grain width, 100 gm wt. etc.) of these varieties and attempts are being taken to conserve them for sustainable agriculture.

Keywords

Conservation, agro-botanical characters, Folk rice, sustainable agriculture, West Bengal.

Introduction

Rice the staple food of West Bengal, belongs to family Poaceae has wide genetic diversity which consist two cultivated species- *Oryza sativa* and *Oryza glaberrima*. In India rice is cultivated in

around 43.66 Mha land with production of 118.87 million metric tons (after milling) @ 4.08 metric tons/ha. (According to USDA report, April, 2021) [1]. From the historical and scientific point of view it was revealed that rice (*Oryza sativa*) originated in the Hindustan Centre and possess several wild species, a large number of land races and several other varieties [2]. One of the remarkable achievements of plant breeding is 'Green revolution' which led to quantum jump in yield, because of increased productivity, wider adaptability coupled with adoption of improved production technologies. Role of 'Green revolution' in achieving status of self-sufficiency in food grain is beyond any doubt but 'high yielding varieties', the major key factor of green revolution, have indirectly stimulated erosion of landraces and others wild varieties of rice [3]. Currently more than 90% of rice cultivation is being done using 'high yielding variety' only. Obviously land races or folk varieties are disappearing at a very fast rate. Importance of landraces is larger than life in agriculture system, because improvement in existing variety depends upon desirable genes which are possibly present in landraces and wild species only [4]. Proper conservation and restoration of folk varieties is necessary otherwise we may lose these naturally growing varieties. As most of the landraces are in informal agriculture sectors, our information about them is incomplete and out of date [5]. Future rice cultivation and production exclusively depends upon conservation of these landraces. Another important issue is sustainable agriculture in present situation where climate change is adversely affecting agricultural productivity [6]. Beyond any doubt, local varieties which are sustained in particular climatic condition since thousands of years back are better suited as compared to HYVs, proper solution of climate change as well as

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agriculture may successfully rest on conserving these rice varieties.

Glaszmann (1987) classified *Oryza sativa* into six groups: japonica, aromatic, indica, aus, rayada (floating rice of Bangladesh), and ashine (Indian floating rice) [7], whereas Garries et al. (2004) classified it into five groups: temperate japonica, tropical japonica, aromatic, indica and aus [8]. According to an estimate about 120000 distinct rice varieties was reported throughout the world among them approx. 80000 are preserved in IRRI, and China and India have 40000 and 25000 collection respectively [9]. Indian subcontinent also possessed large number of rice varieties in recent past. Indigenous farmers selected the varieties as per their own requirement and built a strong agrobiodiversity and it took several centuries. West Bengal also was a home land of thousands of folk varieties and thousands of folk varieties evolved through natural selection. According to an estimate during 1930 united Bengal had possessed 15000 folk varieties of rice [10]. After the introduction of modern rice or so called 'high yielding varieties' folk varieties or traditional rice varieties have been decreasing very fast since mid-1970 to 1980 and currently a handful of such varieties exist from the more than 5500 varieties [11]. In this study I have conserved and cultivated 130 folk rice varieties predominated in West Bengal. Along with the conservation and restoration of these varieties some agro-botanical characters were also investigated.

Materials and Method

Extensive survey was conducted in remote villages of various districts of West Bengal from year 2010-2015 to study the availability of existing germplasm of traditional of folk rice varieties. Handful of viable seeds was collected from the marginal farmers which are not available in repository of the Amarkan Rural Socio Environmental Welfare Society (ARSW Society), an agro-biodiversity conservation centre of Bankura Districts of West Bengal (www.arswsociety.in). Seeds of local landraces or folk varieties were planted on farm land of ARSW Society. On farm cultivation and conservation of these varieties has been conducting on farm land of ARSW Society from the year 2008 to present session (2021-22) uninterruptedly to produce large amount of viable seeds.

In this conservation work 130 traditional varieties of rice have been executed. List of traditional varieties of rice cultivated and their important

characteristics are given in Table 1. Total conservation process was divided into three phases. These are 1. Cultivation and seed multiplication, 2. Harvesting and processing of cultivated farmers varieties for storage; 3. Development of conventional seed storage system for proper storage and maintenance of these varieties; and 4. Agro-botanical characterization of these varieties.

Each variety has grown in a study plot of 6m² with a uniform spacing of 25 × 20cm in control condition without giving any chemical fertilizers (Fig-4). In next stage of the work cultivated rice varieties have been harvested from the field and transferred to the farm for threshing, cleaning and storage. Each variety has been harvested separately and rice seeds were separated mechanically and cleaned by traditional winnowing method using basket made of bamboo locally called 'kulo' and after cleaning, seeds were kept in the locally made pitcher pot made of clay. A conventional seed storage system has been developed for proper storage and maintenance of these traditional rice varieties. Each variety has been kept into the pitcher pot made by clay and mouth of the pitcher covered with small cap made by clay and sealed with mud for proper maintaining of moisture (Fig-5). These seeds will be provided to the marginal farmers for large scale cultivation in next growing session. Every year after the growing season (July-December) seeds were traditionally stored into the seed pot for the development of seed bank.

Different agro-botanical characteristics of these landraces were recorded and documented at different stages of growth following National guidelines for the conduct of Test for Distinctness, Uniformity and Stability of Rice (*Oryza sativa* L.) [12] simultaneously with cultivation and conservation process. In this study following agro-botanical characteristics were documented like weight of 100 mature and fully developed grains, length and width of grain, length/width ratio, kernel length and width and shape, aroma etc. These parameters provided valuable agronomic characteristics of traditional rice varieties on the basis of these farmers can select specific rice varieties in their own choice for the cultivation.

Results and discussion

Folk or traditional rice varieties show wide variation in agro-botanical characters. Grain length of the 130 traditional rice varieties shows variation between 5.33 mm to 11.2 mm. The highest length

(i.e. 11.2mm) has been observed on Patnai-23 varieties and the lowest length (i.e. 5.33mm) has been observed on Tulsimukul variety. Patnai-23 is a long duration variety which was widely cultivated in several districts like south 24 pargana, Midnapur, Bankura district of West Bengal in recent past. Tulsimukul is an aromatic variety with high esthetic value. Grain width of these varieties shows variation between 3.67mm to 1.8mm. The highest width has been observed on Shrabanti (3.67mm) variety and lowest width has been observed on Kataribhog variety (1.3mm). Shrabanti is a medium duration low land variety with brown lemma and palea colouration with long bold kernel shape. Kataribhog is also an aromatic variety with high market demand. Wide variation has also observed in decorticated grain or kernel length and width of these studied varieties. Maximum kernel length has been observed on Sindurmukhi variety (8.8mm) and minimum length has been observed on Tulsimukul variety (3.83mm). Highest kernel width has been noticed on Khajurchari variety (3.16mm) and lowest value has been observed on Kataribhog variety (1.6mm). Weight of 100 fully developed grains is an important agronomic character. Highest grain weight has been observed on Lakkansal variety and it was 3.38gm/100 grain and

minimum grains weight has been found on Monibhog variety and it was only 0.95gm/100grains among the studied 130 traditional rice varieties. Several variations has been observed in grains shape. Maximum varieties shows long bold and short bold type of grain shape, some varieties have medium slender type of grain shape. Very few varieties shows different type of grain shape like Basmati type (Dangapatnai, Moargjhata, Lalkamal variety etc.), Extra-long slender (Patnai-23, Lakkansal variety, etc.). Table-2 shows the overall quantitative data of agronomic characters of 130 traditional rice varieties and Figure. 1-3 shows the graphical representation of comparative analysis of various agro-botanical characters of studied 130 folk rice varieties.

Aroma is an important agronomic and qualitative character of any rice varieties. Many folk rice varieties possess this important character. In present study 18 rice varieties shows this important characters these are, Auskhas, Basmati, Chatuimukhi, Joha, Kalogandheswari, Kalojira, Kalonunia, Karikkhas, Kararibhog, Mihidana, Mihigandheswari, Monibhog, Motibas, Paramananda, Randhunipagol, Shyam, Tulaipanji and Tulsimukul etc.

Table1: List of the conserved 130 traditional rice varieties and their important agro-botanical characters

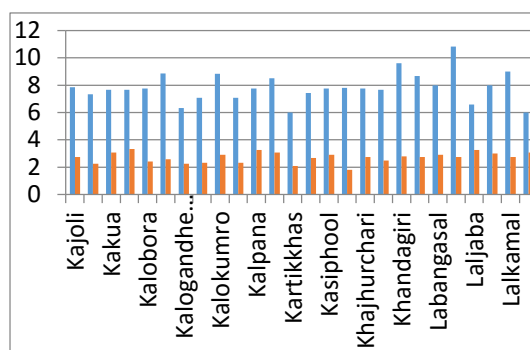
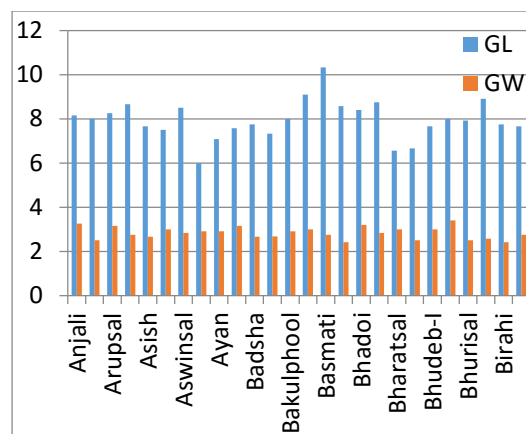
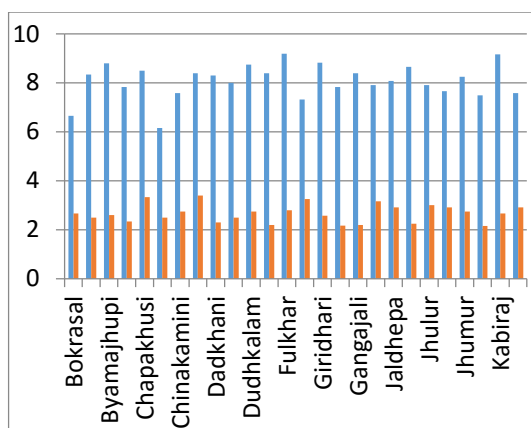
Name	Shape	Name	Shape	Name	Shape	Name	Shape	Name	Shape
Anjali	LB	Bokrasal	SB	Kajoli	SB	Lalparul	LB	Nabanna	SB
Arka	LB	Bombaimugi	LB	Kakrisal	LS	Lalpatni-sk	LB	Najanisal	MS
Arupsal	LB	Byamajhupi	LS	Kakua	LB	Latika	MS	Nandini	LB
Ashinlaya	MS	Chandrakanti	MS	Kalobyar	LB	Latisal	LB	Nirjhara	LB
Asish	MS	Chapakhusi	LB	Kalobora	MS	Likekakua	LB	Panati	LB
Asitkalma-II	SB	Chatuimukhi	SB	Kalodhopa	LS	Lilamoy	LB	Pankhiraj	LB
Aswinsal	LB	Chinakamini	SB	Kalogandheswari	SB	Lohasal	MS	Paramananda	LB
Auskhas	SB	Chotodidi	LB	Kalojira	MS	Lokdisal-I	LB	Parbati	LB
Ayan	SB	Dadkhani	MS	Kalokumro	LS	Lokhindar	LB	Patnai-23	ELS
Badamidhan	SB	Dangapatnai	BST	Kalonunia	MS	Lulisada	SB	Raghusal	LS
Badsha	LS	Dudhkalam	LB	Kalpana	SB	Malabati	LB	Randhunipagol	SB
Bakrisal	MS	Dudherswar	LS	Karabisal	LB	Malsiraj	LB	Riksal	SB
Bakulphool	SB	Fulkhar	LS	Kartikkhas	SB	Maniksal	SB	Sabitri	LB
Bashphool	LB	Gheush	SB	Kartiksal	SB	Mashuri	MS	Shatisal	LB
Basmati	ELS	Giridhari	LS	Kasiphool	SB	Mayna	LB	Shimulphool	SB
Baspati	LB	Gokulsal	SS	Kataribhog	MS	Medi	LB	Shiuli	SB

Bhadoi	LB	Gangajali	LS	Khajhurchari	SB	Mihidana	SB	Shrabanti	LB
Bharati	LB	Jaladhi	SB	Khajurkanta	MS	Mihigandheswari	SB	Shyam	SB
Bharatsal	SB	Jaldhepa	LS	Khandagiri	LS	Mohonmala	SB	Sitapi	LB
Bhasamanik	LB	Jhilik	SB	Kirti	LB	Monibhog	SB	Sindurmukhi	LS
Bhudeb-I	SB	Jhulur	SB	Labangasal	LB	Morogjata	BST	Sundari	SB
Bhuri	LB	Jhulur-2	SB	Lakkansal	ELS	Moti-1	LS	Triguna	MS
Bhurisal	LB	Jhumur	LB	Laljaba	SB	Motibas	SB	Tulaipanjiran	LS
Binnidhan	LS	Joha	LS	Lalkalma	MS	Mugisal	LS	Tulsimumkul	SB
Birahi	LB	Kabiraj	LS	Lalkamal	BST	Mukta	LS	Velchi-1	LS
Birahisal	SB	Kajalsundari	SB	Lalmarich	SB	Murkimala	LB	Vherisal	MS

Table2: Statistical analysis of agro-botanical data of 130 traditional rice varieties

characters	Mean	Median	Mode	Minimum	Maximum
GL	7.94	8	8, 7.66	5.33	11.2
GW	2.76	2.75	2.75, 3	1.8	3.67
KL	5.98	6	6	3.83	8.8
KW	2.317	2.315	2.5	1.6	3.16
GWt	2.152	2.21	2.45	0.95	3.38

LEGENDS- **GL-** Grain length (mm); **GW-** Grain width (mm); **KL-** Kernel length(mm); **KW-** Kernel width (mm); **GWt-** Grain weight of 100 bold grains (gm); **SB-**Short bold; **LB-**Long bold; **LS-** Long slender; **MS-**Medium slender; **ELS-**Extra-long slender; **BST-**Basmati type.



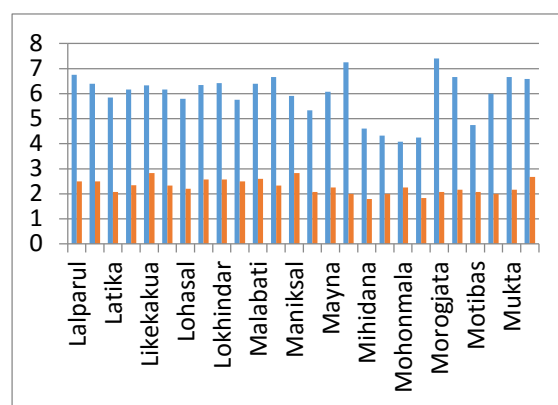
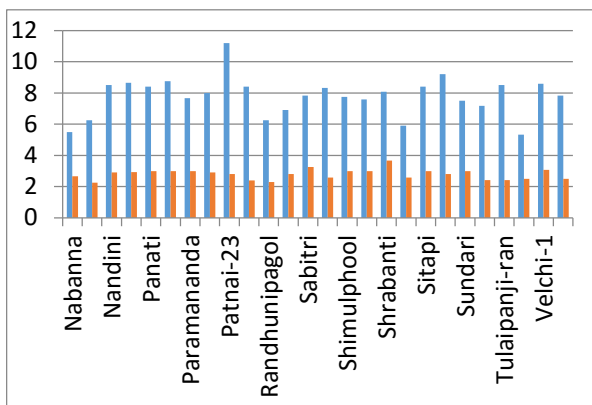
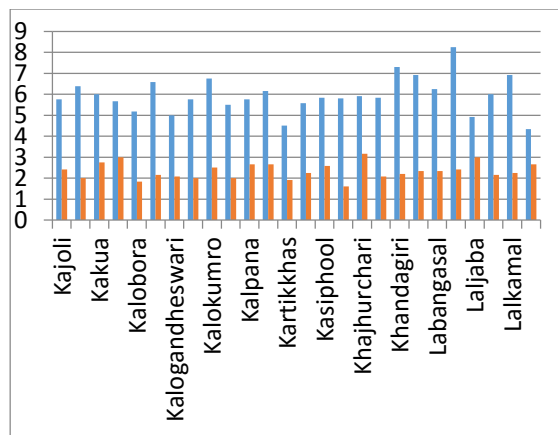
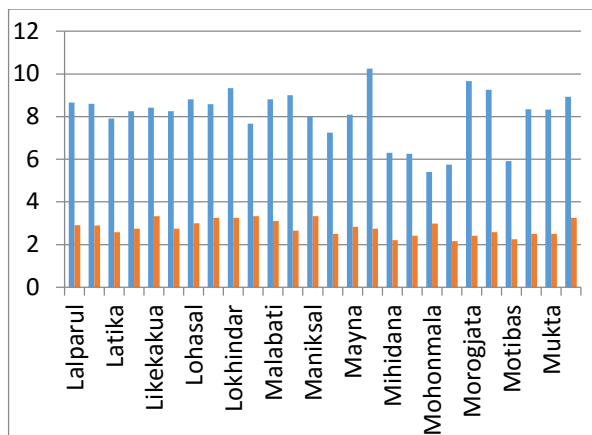


Fig 1. Graphical representation of comparative analysis of Grain length (GL) and Grain width (GW) of 130 folk rice varieties.

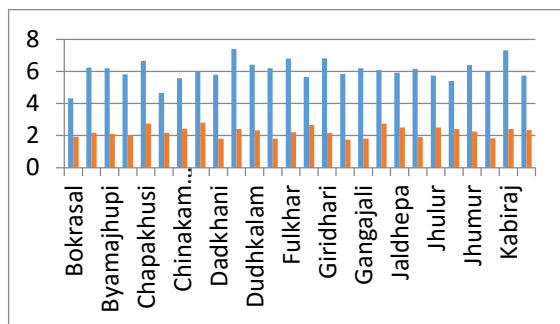
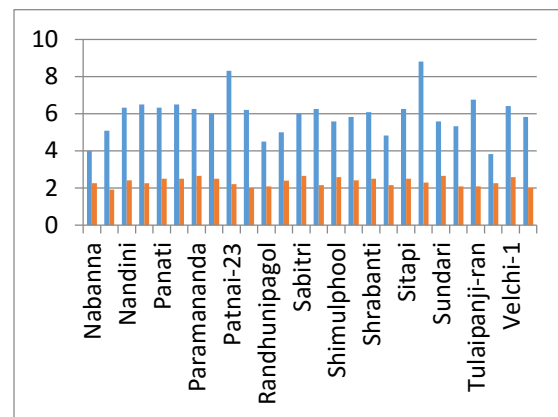
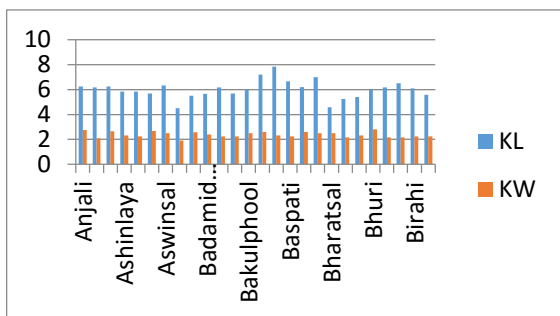


Fig 2. Graphical representation of comparative analysis of Kernel length (KL) and Kernel width (KW) of 130 folk rice varieties.

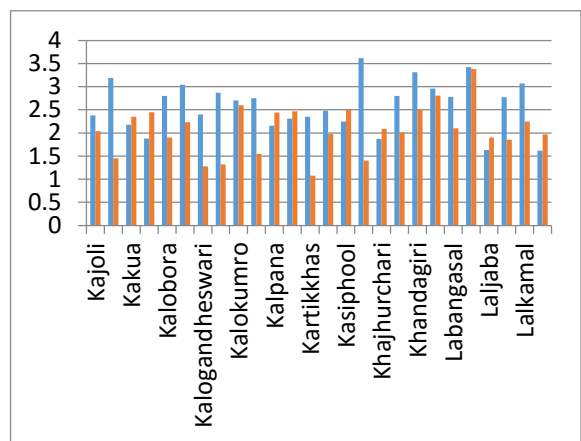
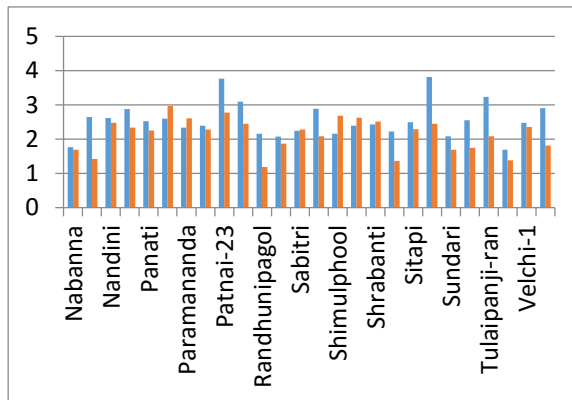
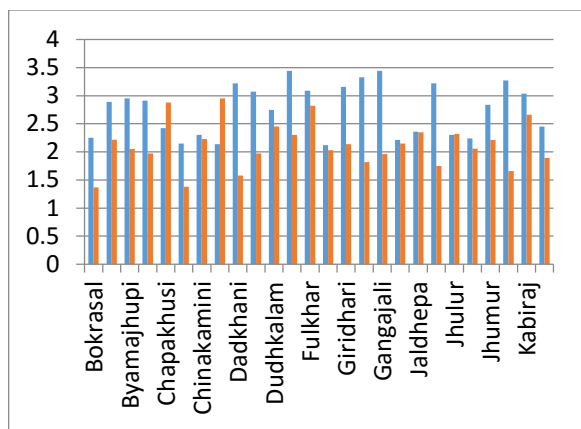
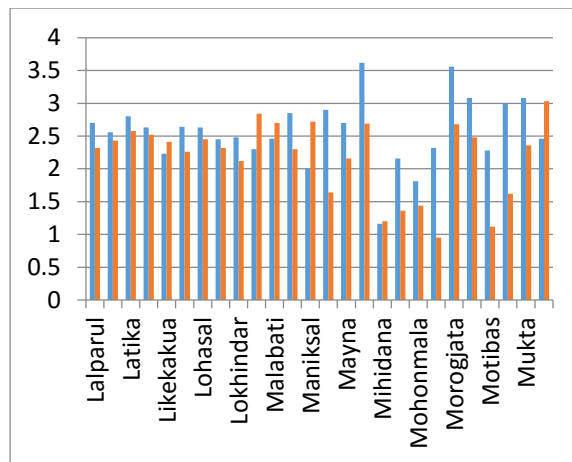
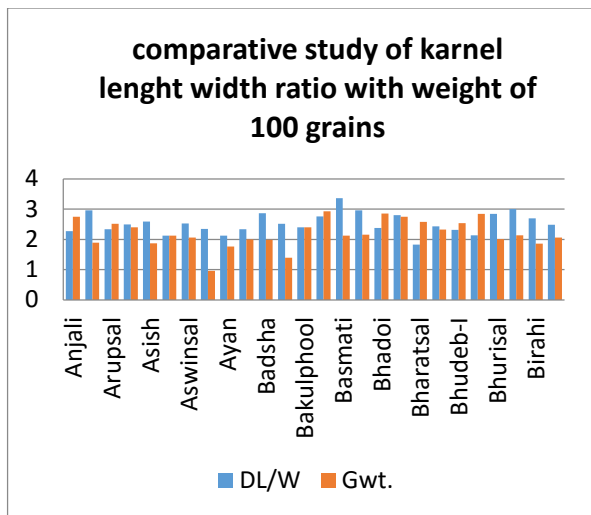


Fig 3. Graphical representation of comparative analysis of Kernel length (KL- mm) and Kernel width (KW- mm) of 130 folk rice varieties.



Fig.4 Various stages of on farm cultivation of 130 folk rice varieties of West Bengal

