



Yields and its Component Characters in Upland Rice of Manipur

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ABSTRACT

Background: Yield is a complex entity. The pre-requisite for achieving high yields in rice depends on identification of superior new genotypes for various traits associated with yield. These characters may help in advancing the yield like the plant height, tillers per plant, length of panicle, grains per panicle, grain weight and their relationship with yield and direct and indirect contribution to grain yield. The present study was conducted to identify the yield and its related characters of all the rice cultivars which are collected from the hill farmers of Manipur.

Methods: Field experiment of 90 local rice cultivars were conducted in the experimental farm of ICAR, Lamphel, Imphal, Manipur. Sample random sampling technique with a sample size of 6 competitive plant were study in the present study. Data of plant height, total tillers per plant, length of panicle, total spikelet's per panicle, grain per panicle, grain weight, grain yield per plant were analysed.

Result: The present finding shows that a large number of local cultivars are used by the hill farmers of Manipur without appropriate selection. Some of these cultivars were having those agronomic traits which are considered to be associated with yield characters of rice. If improved high yielding varieties for upland rice cropping is not available to the farmers' they can select to those local cultivars having desirable yield characters.

Key words: Cultivars, Panicle, Saved seed, Tiller, Yield indicator.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereal crops. It is source of food to over three and a half billion people and contributes more than 20% of total dietary calories (Khush, 2013). In India, it covers the largest area under rice about 44.6 million ha of land with a production of about 90.2 million tons (Anonymous, 2009). According to second advance estimates of Government of India, rice production in 2013-14 is likely reaching a record 106.19 million tons (Anonymous, 2014). Upland rice is the staple food of the poorest farmers in Asia and Africa. In the North East India, the major area of upland rice is in the slash and burn system; commonly known as jhum cultivation. In this system, productivity is low and ranges from 0.8-1.2 t/ha (Sarma and Pattanayak 2009).

Manipur, in the North-East region of India, lies between longitude 93.03°E to 94.78°E and Latitude 23.83°N to 25.68°N with a total geographical area of 22,327 sq.km. the land may be divided into two districts physiographical division - the hills comprising 90 per cent of the geographical area with five revenue districts viz, Chandel, Churachandpur, Senapati, Tamenglong and Ukhrul and the valley occupying only 10 per cent with four revenue districts. The total acreage under rice crop during 2014-15 crop season is 2,24,380 ha with a total grain production of 3,98,060 tonnes. Out of the total acreage under rice crop the share of the five hill districts is 8,88,20 ha with an annual production of 1,40,840 tonnes. On the other hand, the four valley districts produced 2,57,220 tonnes from an acreage of 1,35,560 ha (Table 1). Thus, the rice productivity of the hill districts is very low in comparison to valley districts. According to 2001 census, the population of Manipur has been reported as 2.312 million with a total estimated rice requirement of about 485.5 thousand metric

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tonnes. Whereas the average production productivity of Manipur per annum is about 477.21 thousand metric tonnes and 2246 kgs. per hectare, respectively, estimating an annual deficit of about 8.289 thousand metric tonnes (Anonymous, 2001). Since, the availability land area for cultivation of rice is limited, we need to increase the production and productivity of rice to meet the deficiency of total rice requirement of the state through intensification of cropping by adopting rice based multiple cropping system, wherever possible, and through increase use of superior genotypes for higher yielding potentiality with appropriate production technology.

Yield is a complex entity. The pre-requisite for achieving high yields in rice depends on identification of superior new genotypes for various traits associated with yield Ramalingam *et al.*, (1993) observed that total filled grains showed both positive genotypic association as well as direct effect on rice yield. Similarly, many workers also attempted to identify the major contributing components of yield in rice like plant height, number of productive tillers, panicle length, number of grains per panicle and test grain weight and their relationship with yield and direct and indirect contribution to grain yield (Mahajan *et al.*, 1981; Ghorai and Pandey, 1982).

Keeping them in view, the present study was conducted to identify the yield and its related characters of all the rice cultivars which are collected from the farmers of the 5 hill districts of Manipur.

MATERIALS AND METHODS

Seed samples of rice cultivars were collected from the five hill districts of Manipur during the year 2014-15. Method of seed samples collection as per the suggestion made by Chang *et al.* (1972) i.e. collection from farmer's home of about 500 g of seed. The seed samples under the same local name were sorted out for examination.

Field experiments of 90 local rice cultivars were conducted in the Experimental Farm of the ICAR, Lamphal, Imphal (Manipur). The Experimental Farm is located in 24° 48' 35" latitude and 93° 52' 75" longitude with an altitude of 790 m above MSL. The climate is sub-tropical with a maximum temperature of about 35°C during the month of May and June and a minimum of about 0°C during December and January. The experimental field has clayey soil and pH of about 5.5.

After appropriate preparation of the soil, seeds of the 90 rice cultivars were sown directly separately in separate beds at the seed rate of 80 kg/ha. Fifty seedling were uprooted after 25 days of sowing and transplanted at a spacing of 20 cm row to row and 15 cm plant to plant in the well puddle experimental field with 2 replications. For other management practices, recommended package of practices of growing a good rice crop were followed. However, no fertilizers, no fungicidal or insecticidal spray was used.

Simple random sampling technique with a sample size of 6 competitive plants hill was followed in the present studies. Each plant hill was taken as a sampling unit. The boarder rows were excluded while taking the samples. Data were analysed for the following parameters:

a) Plant height

Plant height was measured in cm at maturity by recording the height from the ground level to the tip of the tallest panicle.

b) Total number of tillers per plant

Total number of tillers was recorded by counting the number of tillers in a random sample size of 6 plants at maximum tillering stage.

c) Length of panicle

Length of the panicle in cm. was measured as the distance from the neck node to the tip of the panicle.

d) Total spikelet's per panicle

The total number of spikelets per panicle was recorded by counting the filled and unfilled grains in each panicle.

e) Grain per panicle

The total number of grains per panicle was recorded by counting the filled grain in each panicles discarding the sterile spikelet's.

f) 100 grain weight

Weight of 100 filled grains was recorded after harvesting, threshing and winnowing from 6 random plants and expressed the grain yield per plant as their mean.

g) Grain yield per plant

Grain yield per plant was recorded after harvesting, threshing and winnowing from 6 random plants and expressed the grain yield per plant as their mean.

RESULTS AND DISCUSSION

A large number of local varieties of rice are still widely cultivated by the farmers of five hill districts of Manipur. It shows that the farmers are not well aware of the benefits of modern agricultural practice and of using high yielding varieties. The worth of a cultivar is determined by the worth of its agronomic characters, particularly the grain yield. Grain yield is a product of major components of agronomic characters like plant height, number per panicle and grain weight. Table 1 shows the plant and yield characters, viz., plant height, total tillers per plant, panicle length, spikelet's per plants, grains per panicle, 100 grain weight and grain yield per plant of the rice cultivars grown by farmers in the 5 hill districts. Table 2 shows the maximum and minimum ranges of the six yield components.

The plant height as high as 164.28 cm. among the cultivars was recorded from the cultivar Ohuro and 150.40 cm from Leitani apouba. However, Thoibi (78.53 cm), Tombung (79.35 cm) and Nabdumi (80.73 cm) were the cultivars having the plant height less than 100 cm. Such a great variation in the plant height of local upland rice cultivation would certainly give an opportunity of developing varieties of different plant height for varied ecological conditions of Manipur hills.

Among the rice cultivars of Manipur hills, total number of tillers per plants was highest from the cultivars Noining 10.67 and lowest from the cultivars Chanapati 5.24. As far as spikelet's and grains per panicle were concerned, Sahoksan recorded with the highest number of spikelet's (289.33) and 232.17 grain per panicle. Mankok had the highest panicle length of 35.20 cm and Kijumangm had the lowest with 18.48 cm. Also, Mankok had the highest grain weight of 4.02 g per 100 grains and Phou amuba had the lowest with 1.68 g per 100 grains. The highest grain yield per plant was recorded from the cultivar Akhanphou (39.55 g).

The highest plant height was found in Ohuro (164.28 cm) and its grain yield/plant was 35.44 g., but highest grain yield/plant was found in Akhanphou (39.55 g) and its height was 136.78 cm. Rahimi *et al.* (2010) reported the presence of the significant negative correlation between plant height and rice grain yield.

However, in the present study panicle length recorded positive effect on grain yield as reported by Toshimenla *et al.* (2016) followed by grain number as reported by Ghorai and Pandey (1982) and plant height was observed by Mani

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Table 1: Yield component of rice cultivars grown by hill farmers of Manipur.

Name of cultivars	Plant height (cm)	Total tillers per plants	Panicle length (cm)	Spikelet's per panicle	Grains per panicle	Grains yield per plant (g)	100 Grain weight (g)
Ansharang ma	153.57	7.50	30.28	172.17	143.33	33.36	3.45
Akhanphou	136.38	10.17	24.32	163.17	141.50	39.55	3.21
Akia	102.42	8.67	20.08	129.67	93.67	23.39	2.45
Bilkuangbuh	133.67	6.83	24.38	106.83	82.17	20.54	2.93
Bounga	125.60	7.67	20.10	169.83	113.33	22.56	2.73
Bungpat	95.28	5.50	25.70	283.67	197.33	27.42	2.1
Buhman	130.47	5.67	23.45	135.00	113.33	25.85	3.05
Burma phou	132.87	7.83	29.23	246.17	180.50	28.63	2.84
Chahao	134.45	6.50	24.57	175.00	123.33	23.60	3.14
Champi	134.20	6.50	25.55	185.33	170.50	29.30	2.94
Champra	133.60	7.17	21.60	138.17	120.00	30.44	3.29
Chanapati	112.63	5.24	25.18	153.33	120.67	18.49	2.47
Chandrakriti	124.58	7.83	22.42	186.17	153.83	30.11	3.12
Chandrashaker	89.50	5.67	21.57	139.33	115.00	29.23	3.63
Changat	132.47	6.83	25.18	249.00	198.33	31.17	2.43
Changlei	110.82	8.33	25.48	172.17	147.50	30.30	2.56
Changman	143.15	5.67	32.37	195.17	155.50	28.10	2.91
Chapheng	122.58	5.50	23.53	165.67	110.33	16.55	1.99
Chinaphou	125.32	5.67	23.25	138.50	98.33	19.72	2.51
Chingphou	114.38	5.50	25.60	123.67	84.33	23.40	2.73
Chyampokpi	84.17	6.83	21.60	115.17	51.17	13.85	3.2
Gulbuh	144.62	6.50	26.42	164.17	119.50	20.52	2.32
Huikap	90.65	7.50	23.47	110.33	83.33	23.56	2.97
R.I	80.68	6.50	22.63	127.33	95.67	22.24	2.24
Istoma	129.52	7.33	25.35	169.50	146.17	27.90	3.01
Kahaola	137.68	7.33	23.60	150.00	125.33	26.68	3.02
Kakcheng	138.55	7.67	24.70	172.50	114.67	19.50	2.47
Kaphuza	138.40	8.50	29.13	178.17	140.50	28.32	2.31
Karlong	112.30	5.33	23.78	106.50	84.17	15.46	3.08
K.D.	82.43	7.50	22.58	180.33	150.83	38.43	2.84
Khonghing	140.22	7.33	24.58	195.17	142.17	18.18	2.75
Kiophou	103.65	8.00	22.05	113.17	85.83	23.21	2.51
Kiujimang	128.48	6.17	18.47	124.67	97.67	23.29	2.02
Kumbi phou	123.12	7.67	21.50	163.33	113.83	27.37	2.47
Lainingphou	98.52	10.03	24.55	125.00	98.67	26.48	2.96
Lamyang	125.37	6.50	30.13	136.17	98.50	28.82	2.86
Langmei	135.08	6.83	27.60	130.67	115.33	27.41	3.01
Langphou	127.60	7.33	23.48	194.17	172.50	32.82	2.79
Leitan	148.65	6.83	26.20	233.00	187.67	33.77	3.3
Leitan apouba	150.40	6.50	24.37	193.50	126.50	30.47	3.12
Lubanglong	83.73	5.50	22.30	182.17	115.67	25.35	3.2
Miri	89.77	5.67	19.75	102.67	50.33	15.35	2.58
Milong Tei	99.48	7.33	21.35	120.50	92.50	13.76	2.94
Majinlipui	103.48	5.50	19.45	119.33	85.17	18.57	3.19
Mama ma	125.15	8.83	26.13	132.83	84.17	23.24	2.69
Maneyo	133.32	6.67	22.42	126.33	103.33	27.61	2.69
Mankok	145.33	7.50	35.20	212.33	172.83	38.89	4.02
Maorola	131.60	7.83	19.48	92.50	87.00	15.32	2.47
Marongza	129.37	6.50	24.80	14 6.33	112.67	18.30	2.39

Table 1: Continue.....

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Matei mata	130.27	5.50	21.60	139.33	103.17	25.49	3.43
Maziuro	124.28	6..50	26.67	153.17	129.17	27.03	2.15
Mikoro	122.10	8.67	23.45	155.50	125.50	32.77	3.28
Mohor	104.55	5.67	23.08	183.83	170.33	24.17	2.38
Mojha	132.77	7.50	20.13	129.50	104.33	20.37	2.35
Moirangphou	127.83	9.33	23.45	140.33	120.17	32.70	3.03
Moirangphou amubi	132.35	7.33	21.67	132.67	107.50	25.46	2.8
Moirangphou chingi	88.80	6.33	27.10	218.17	192.17	29.94	2.17
Moirangphoukhongnambi	86.40	5.50	24.52	152.17	123.50	22.78	3.05
Nabdumei	80.73	5.50	23.45	168.33	115.17	18.48	2.96
Nagahongma	122.20	6.83	26.28	149.33	103.00	19.92	2.47
Nagaphou	75.60	7.83	21.33	143.33	98.67	18.49	2.52
Naga special	136.32	6.67	23.28	152.83	120.67	20.46	2.46
Napadai	115.42	5.83	27.25	194.50	177.50	28.77	2.84
Noining	137.37	10.67	14.48	247.33	103.33	38.83	3.32
Nungsii	116.45	6.67	25.42	149.67	103.50	24.63	2.34
Ohuro	164.28	6.33	27.25	253.17	220.50	35.44	2.89
Oriyo	124.45	6.50	19.55	103.50	90.17	20.47	3.45
Palbem	110.90	5.83	25.45	119.83	80.50	19.06	3.02
Milong Tei	81.57	5.50	21.47	108.33	49.33	15.47	2.8
Phaichang	93.53	5.50	22.82	129.50	93.50	17.30	2.43
Phe charang	125.47	6.17	24.42	158.00	124.67	23.49	2.92
Phe charo	138.62	6.83	27.57	143.17	120.17	28.07	3.02
Phou amuba	134.36	5.67	24.68	163.33	74.83	14.44	1.68
Phourem	137.37	7.67	23.07	192.17	127.17	39.09	3.35
Phoudum	110.40	6.83	20.13	127.33	80.17	19.41	2.67
Phuring	138.43	9.00	24.62	166.50	146.33	29.33	2.56
Pumba phou	113.48	6.67	22.42	132.50	95.67	21.41	2.63
Ramchang ma	147.84	8.67	29.67	205.50	188.50	32.45	3.03
R.C.M.	93.63	7.67	23.25	125.50	85.33	29.27	2.8
Sahoksan	143.28	7.50	27.30	289.33	232.17	36.46	2.47
Siroima	88.40	5.50	27.57	207.33	150.17	26.45	2.73
Sulam phou	140.33	5.50	27.57	207.33	150.17	26.45	2.73
Thaisen	90.47	6.67	21.53	105.00	89.50	23.46	2.86
Thoibi	78.54	7.67	23.55	104.33	80.17	25.19	2.82
Thinjachang	141.60	8.33	22.92	246.33	213.33	30.06	3.11
Tolen phou	128.27	5.67	22.65	132.33	117.67	25.63	2.77
Tombung	79.35	7.83	28.50	98.33	85.50	18.61	2.98
Torangza	123.52	8.50	21.30	153.50	122.50	24.30	2.55
Unidentified	136.55	7.67	22.67	116.33	96.17	21.42	2.82
Yaphurma	139.22	5.67	22.68	172.50	127.50	20.45	3.38
Mean	119.850	6.983	24.1555	158.343	121.323	25.973	2.799
CV	17.911	20.998	14.208	26.998	31.380	61.9444	14.182
CD 5%	3.195	1.037	2.182	7.694	5.790	16.264	1.100

(1981). Similarly, Mankok has the highest panicle length (35.20 cm) and its yield/plant was 38.42 g which was the third highest yield/plant but for Akhanphou panicle was 24.32 cm. This was slightly contrast with the observation of Paramasivan and Sree Rangasamy (1988) where plant height and panicle length also had strong positive association with grain yield as well as productive tillers/plant. International Rice Research Institute (IRRI) (1997) stated

that traits contributing to yield potential in rice include tillering ability, leaf length, leaf width, number of leaf, number of panicle length of grain and amount of grains on the panicle.

The highest productive tillers/plants were found in Noining (10.67) and which was second highest grain yield/plant (38.83 g) whereas the highest grain yield/plant was Akhanphou (39.55 g) but which produced second highest productive tiller/plant (10.17). Grain weight and tiller number

Table 2: Diversity of Agronomic character of 90 local cultivars of Manipur hill.

Character	Minimum	Maximum
Plant height	164.28	78.54
Total no. tillers per plants	10.67	5.24
Panicle length (cm)	35.20	18.47
Spikelet's per panicles	289.33	92.47
Grains per panicle	232.17	49.35
100 grain weight (g)	4.02	1.68
Grain yield per plant (g)	39.55	13.82

exhibited positive direct effect on yield as observed by Mani (1981). Sundaram *et al.* (1988), Paramisavan and Sree Rangasamy (1988) and Mahajan (1993) also reported that the highest degree of association between the productive tillers/plant and grain yield indicated that number of productive tiller/plant is highly reliable component of yield and can very well be utilized as an yield indicator in yield trials. Gravois and Helms (1992) showed that at different seeding rates, the direct effects of filled grain panicle-1 on rice yield were moderate and positive. Ramalingam *et al.*, (1993) observed that total filled grains showed both positive genotypic association as well as direct effect on rice yield.

Gopinath *et al.* (1984) also considered productive tiller/plant and filled grains/panicle important yield component of rice. The 100 grain weight had high +ve contribution towards yield, but indirect contribution of it via tillers/plant and filled grain/panicle. The present findings were in accordance with the findings by Mahalingam *et al.*, (2012).

CONCLUSION

The present finding shows that a large number of local rice cultivars are used by the hill farmers without appropriate selection. Some of these cultivars were having those agronomic traits which are considered to be associated with yield characters of rice. If improved high yielding varieties for upland rice cropping is not available to the farmers they can select those local cultivars having desirable yield characters. A more intensive study in this area for selection of those rice cultivars with high yielding traits will be fruitful.

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