Indian Journal of Hill Farming, (2024); 37(2):37-43
doi: 10.56678/iahf-2024.37.02.6
ISSN: 0970-6429
ijhfonline.org

RESEARCH ARTICLE

Quality Status of Farmers' Rice Seed in Hill Districts of Manipur

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Abstract

About 250 seed samples were collected from the farmers of hill districts of Manipur to assess the quality status of farmers' saved rice seeds. Farmers generally store their saved seeds in kotlus, gunny bags, bamboo mats, mud-pastured stored structures, and even in tins and drums without any seed treatment These samples were subject to physical purity analysis, germination test, and moisture content. Only 46.8% of seed samples had 80% seed germination. Out of 250 seed samples, 96 seed samples could meet the permissible seed moisture level. In the pure seed test, only 6 samples could meet the pure seed range of 98%. In the overall seed quality assessment in hill districts, only one sample out of 250 samples could meet the Indian Seed Standard for certification with regard to different quality components. Thus, the quality of farmers' saved rice seed in Hill Districts of Manipur was very much substandard.

Keywords: Seed, Seed germination, Purity, Quality.

Introduction

Seed is the most important input in all crop-based farming systems, determining the upper limit on yield and therefore on the ultimate productivity of all other inputs. It has been estimated that a 15 to 20% increase in food production could be achieved by the use of high-quality seeds of improved varieties. Jain and Chand (1999) emphasized the importance of seed by stating that seed is not just another input, it is a dynamic instrument for change. According to them, among the four factors, viz., quality of seed, edaphic factors, management level, and post-harvest technology, which largely determine the agricultural productivity of a country, the quantity of a seed is the most important factor. According to Balasubramanian *et al*. (2001), seed quality is defined by four characteristics of a seed, viz, genetic purity, physiological quality, physical quality, and health quality.

Manipur, in the northeast 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 distinct physiographical divisions – the hills comprising 90% of the geographical area with five revenue districts viz, Chandel, Churachandpur, Senapati, Tamenglong, and Ukhrul and the valley occupying only 10% with four revenue districts Viz, Imphal East, Imphal West, Bishnupur and Thoubal. In the hill districts shifting cultivation (jhuming), terrace cultivation, and contour cropping are practiced according to the nature of the soil and the physiographic (slope and gradient) of the farming area. The general duration of the jhum cycle usually takes 5 to 7 years. But, in the hill areas of Manipur especially in the southern districts the duration of the jhum cycle is about 3 to 5 years only. About 3 lakh tribal population in the age-old practice of jhuming. For every 5 members tribal family about one hectare of jhum land is required.

Thus, they are extending their jhum land into the new virgin land. About 900 sq.km. of virgin forest is burnt down every jhum land (Laiba,1992). The estimated areas and production of rice under jhum cultivation in the 5 hill districts of Manipur during the last few years are shown below in Table 1. The total acreage under rice crop during the 2020-2021 crop season is 2,33,7500 ha with a total grain production of 6,02,430 tons. Out of the total Acreage under rice crop share by the five hill districts is 88,820 ha with an annual production of 1,16,480 tonnes. On the other hand, the four valley districts produced 4,95,270 tones from an acreage of 1,44,680 ha. Thus, rice productivity is very low in hill districts in comparison to valley districts.

At the same time, the tribal farmers are ignorant of the modern concept of the scientific farming system. Hence, the study was conducted with the main objective of assessing the quality status of farmers' rice seeds in comparison with the recommended certification standards (GOI,1988).

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How to cite this article: Singh, T.T. 2024. Quality status of farmers' rice seed in hill districts of Manipur. Indian J. Genet., **37**(2):37-43.

Source of support: Nil

Conflict of interest: None.

Received: 30/09/2023 **Revised:** 26/01/2025 **Accepted:** 28/01/2025

Material and Methods

The rice seed samples were collected using the area sampling techniques (Kothari, 1990) during the sowing season of 2020 from five hill districts of Manipur. From each district 5 villages and from each village 10 farmers were randomly selected for seed sample collection. Thus, the total number of seed samples collected was 250. The samples were tested in the laboratory for seed standards, viz., purity, germination, and moisture content as per the ISTA seed testing rules (ISTA, 1985).

Purity test

For the purity test, 3 replicates of 40 g working samples were taken from each collected seed sample. Each working sample was separated into different components, viz., purity seed, other distinguishable varieties, other crop seeds, inert matter, and total weed seeds. Each particle was judged individually, the criteria used were external appearance (shape, size, color, gloss, and surface texture) and appearance in transmitted light. All the results were expressed in terms of weight percentage except for total weed seeds which was expressed as the actual number of weed seeds.

Germination test

Four replicates of 100 pure seeds from each seed sample were placed with adequate spacing on moist substrates of two rolled towel papers. The seeds were loosely covered with another layer of rolled towel paper. The paper rolls were incubated at 27 ± 1℃ in a germinator keeping them upright positions. The seed germination (normal) rate was calculated as a percentage on the 14th day of incubation.

Moisture content

Four replicates of 10 g seeds from each sample were taken for percent moisture content. The seeds were kept in weighing bottles and kept at 70℃ for 2 to 5 hours. After the preheating, each replication was ground using a seed grinder. The seed powder was dried at 130℃ for 2 hours. and the moisture loss was calculated in terms of percentages.

The three results were classified into groups with respect to each quality attribute and compared with the Indian minimum standard (GOI,1988). For each quality attribute data classification was based on the results, ranges, and seed certification limit.

Table 1: Estimated area and production of rice by five hill districts under Jhum and Terrace cultivation during the agriculture year 2018-19 to 2020-21.

A= area in 000 ha. P= Production in 000 Mt.

Name of Districts	*2018-19*		*2019-20*		*2020-21*	
	A	*P*	*A*	*P*	*A*	*P*
Chandel	10.03	11.75	7.84	9.79	10.03	13.35
Churachandpur	29.12	34.00	16.08	31.67	29.12	38.00
Tamenglong	27.45	30.43	27.27	40.50	27.45	35.85
Senapati	12.10	17.20	12.10	20.75	12.10	16.18
Ukhrul	10.12	13.78	10.12	20.20	10.12	13.10
Hill Total	88.82	107.16	73.41	122.91	88.82	116.48

Source: Department of Agriculture, Govt. of Manipur

Result and Discussion

A large number of local varieties are widely cultivated by the hill farmers. The farmers in the hill areas are not aware of the benefits of modern agricultural practices and high-yielding varieties. The development of biotechnology can contribute to increasing and maintaining high levels of productivity (Suresh Chandra Babu,2002). Most of the farmers' seeds, particularly in the area being surveyed, clearly indicated that the seeds were of low quality and much below the Indian seed certification standards concerning the different components of seed certification standards.

The mean level of pure seed in Table 2 for Chandel was 84.56% ± 1.26, Senapati 84.02%

± 1.52, Ukhrul 82.67% ± 1.59 and Tamenglong 70.69% ± 0.87. In the lowest ranges <75%

Ukhrul had the highest proportion 24%, Senapati 22%, Chandel 20%, Tamenglong 14% and Churachandpur 10%. Chandel district had the highest proportion (6%) in the highest range of pure seed 98 to 100%. The overall mean purity level was 84.54% ± 0.61 for the whole hill districts.

The content of other distinguishable variety seeds in different levels is shown in Table 3. Fourteen samples (5.6%), five in Senapati, and four in Chandel. 3 in Ukhrul and 2 in Tamenglong district could conform to the Indian seed standards (0.0- 0.3%). The highest proportions were in the upper impurity range of > 10% and Chandel districts had a proportion of (52%) followed by Ukhrul (50%), Senapati (48%), Churachandpur (42%), and Tamenglong (34%). The high level of other distinguishable variety seeds in most of the samples {94.4% (100–5.6%)} with an average presence of 11.45% show low seed quality maintenance. Chandel districts show the highest occurrence of (52%) of the upper range of >10% of other distinguishable variety seeds with a mean value of 19.29%. The hill farmers adopted mixed cropping in which different cultivars were being grown during the same season. Because of the shifting, terrace, and contour cropping practices growth of rouges viz., weeds, volunteer plants, wild species, and other types are encouraged.

For the inert matter content (Table 4) only 56 samples (22.4%) could conform to the certification standard (0–2% range). The highest occurrence (38%) was with the range 2 to 4% followed by 0 to 2% (22.4%). The lowest was in the range of > 8% (6%) followed by 6 to 8% (12%). The overall mean for the hill districts was 3.86 ± 0.14%. Among the districts,

Table 2: Pure seed content weight (%) of rice seed samples collected from five hill districts of Manipur

Pure seed range (%)	Districts											
	Churachandpur		Chandel		Senapati		Ukhrul		Tamenglong		Average	
	Occurrence (%)	Mean% (±s.e)*	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)
98–100% (c.s)	1(2%)	98.73(±0.00)	3(6%)	98.30 (±0.14)	1 (2%)	98.08 (±0.00)	1 (2%)	98.66 (±0.00)	0.00	0.00	6 (2.4%)	98.39 (±0.11)
95–98%	6 (12%)	95.74 (±0.26)	3 (6%)	96.95 (±0.38)	6 (12%)	95.75 (±0.39)	6 (12%)	96.91 (±0.33)	7 (14%)	95.78 (±0.33)	28 (11.2%)	96.13 (±0.18)
90–95%	18 (36%)	92.67 (±0.37)	9 (18%)	92.12 (±0.31)	12 (24%)	92.22 (±0.41)	7 (14%)	92.44 (±0.52)	11 (22%)	91.84 (±0.41)	57 (22.8%)	92.30 (±0.19)
85–90%	6 (12%)	86.33 (±0.47)	13 (26%)	87.97 (±0.33)	11 (22%)	88.16 (±0.35)	11(22%)	87.20 (±0.40)	12 (24%)	86.87 (±0.31)	53 (21.2%)	87.41 (±0.18)
80–85%	7 (14%)	82.08 (±0.61)	5 (10%)	81.49 (±0.62)	5 (10%)	81.65 (±0.30)	9 (18%)	83.13 (±0.34)	8 (16%)	82.74 (±0.48)	34 (13.6%)	82.36 (±0.24)
75–80%	7 (14%)	78.28 (±0.41)	7 (14%)	78.05 (±0.43)	4 (8%)	76.91 (±0.79)	4 (8%)	77.33 (±0.77)	5 (10%)	76.77 (±0.76)	27 (10.8%)	77.60 (±0.29)
< 75%	5 (10%)	65.46 (±1.90)	10 (20%)	71.00 (±1.14)	11 (22%)	66.92 (±1.09)	12 (24%)	65.80 (±1.38)	7 (14%)	70.69 (±0.87)	45 (18.0%)	68.08 (±0.69)
Total	50	86.18 (±1.33)	50	84.56 (±1.26)	50	84.02 (±1.52)	50	82.67 (±1.59)	50	85.27 (±1.15)	250	84.54 (±0.61)

*Standard error present.
c.s Certification standard.

Table 3: Percent of other distinguishable varieties of seeds weight in rice seed samples collected from five hill districts of Manipur.

Other Distingu - isable Varieties ranges%	*Districts*											
	Churachandpur		*Chandel*		*Senapati*		*Ukhrul*		*Tamenglong*		*Average*	
	Occurrence (%)	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*
0-0.3% (c.s)	0.00	0.00	4 (8%)	0.12 (±0.05)	5 (15%)	0.03 (±0.01)	3 (6%)	0.14 (±0.06)	2 (4%)	0.00	14 (5.6%)	0.07 (±0.02)
0.3-1%	5 (15%)	0.65 (±0.05)	2 (4%)	0.59 (±0.09)	2 (4%)	0.53 (±0.06)	4 (8%)	0.80 (±0.09)	3 (6%)	1.39 (±0.29)	16 (6.4%)	0.80 (±0.09)
1-5%	15 (30%)	2.77 (± 0.31)	7 (14%)	3.35 (±0.54)	8 (16%)	3.39 (±0.16)	6 (12%)	2.30 (±0.44)	12 (24%)	3.31 (±0.29)	48 (19.2%)	3.03 (±0.17)
5-10%	9 (18%)	7.67 (±0.50)	11 (22%)	8.17 (±0.45)	11 (22%)	7.61 (±0.39)	12 (24%)	8.19 (±0.38)	16 (32%)	7.43 (±0.36)	59 (23.6%)	7.72 (±0.19)
> 10%	21 (42%)	18.42 (±1.48)	26 (52%)	19.23 (±1.17)	24 (48%)	21.01 (±1.47)	25 (50%)	21.78 (±1.63)	17 (34%)	19.10 (±1.49)	113 (42.2%)	20.12 (±0.67)
Total	50	10.01 (±1.24)	50	12.30 (±1.25)	50	12.63 (±1.48)	50	13.21 (±1.59)	50	9.75 (±1.15)	250	11.45 (±0.60)

*Standard error present.
c.s Certification standard.

Table 4: Presence of inert matter weight (%) in rice seed samples collected from five hill districts of Manipur.

Inert matter content range (%)	Districts											
	Churachandpur		Chandel		Senapati		Ukhrul		Tamenglong		Average	
	Occurrence (%)	Mean% (±s.e)*	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)	Occurrence (%)	Mean% (±s.e)
0-2%	16 (32%)	1.49	14 (28%)	1.43	12 (24%)	1.33	10 (20%)	1.44	4 (8%)	1.62	56 (22.4%)	1.44
(c.s)		(±1.13)		(±0.12)		(±0.12)		(±0.12)		(±0.09)		(±0.06)
2-4%	15 (30%)	2.95	20 (40%)	2.79	22 (44%)	2.97	18 (36%)	2.83	20 (40%)	3.16	95 (38%)	2.94
		(±0.15)		(±0.14)		(±0.13)		(±0.14)		(±0.13)		(±0.09)
4-6%	10 (20%)	4.83	13 (26%)	4.67	9 (18%)	4.75	11 (22%)	4.74	11 (22%)	5.15	54 (21.6%)	4.82
		(± 0.18)		(±0.16)		(±0.13)		(±0.17)		(±0.13)		(±0.07)
6-8%	8 (16%)	6.83	3 (6%)	6.36	5 (10%)	6.98	9 (18%)	6.91	9 (18%)	6.98	30 (12%)	6.86
		(±0.21)		(±0.09)		(±0.26)		(±0.27)		(±0.16)		(±0.10)
> 8%	1 (2%)	8.07	0.00	0.00	2 (4%)	9.11	6 (12%)	8.89	6 (12%)	9.82	15 (6%)	9.23
		(±0.00)				(±0.45)		(±0.34)		(±0.53)		(±0.29)
Total	50	3.58 (±0.29)	50	3.11 (±0.22)	50	3.45 (±0.29)	50	4.11 (±0.35)	50	4.96 (±0.35)	250	3.86 (±0.14)

*Standard error present.
c.s Certification standard.

Table 5: Presence of weed seed (actual number) in rice seed samples from five hill districts of Manipur.

Weed seed content range (in No./Kg)	*Hill Districts*											
	Churachandpur		*Chandel*		*Senapati*		*Ukhrul*		*Tamenglong*		*Total*	
	Occurrence (%)	*Mean% (±s.e)**	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*
None (c.s)	18(36%)	0.00	14(28%)	0.00	14 (28%)	0.00	23 (46%)	0.00	19 (38%)	0.00	88 (32.2%)	0.00
1-5%	13 (26%)	3.23 (±0.34)	18 (36%)	2.72 (±0.30)	16 (32%)	2.72 (±0.28)	11 (22%)	3.18 (±0.33)	15 (30%)	2.66 (±0.34)	73 (29.2%)	2.84 (±0.14)
5-10%	9 (18%)	7.89 (± 2.62)	7 (14%)	7.71 (±0.48)	10 (20%)	7.70 (±0.49)	7 (14%)	7.42 (±0.18)	8 (16%)	7.26 (±0.46)	41 (16.4%)	7.56 (±0.20)
10-15%	6 (12%)	12.50 (±0.39)	9 (18%)	11.77 (±1.09)	5 (10%)	12.40 (±0.45)	8 (16%)	12.75 (±0.34)	6 (12%)	12.5 (±0.61)	34 (13.6%)	12.64 (±0.19)
> \15%	4 (8%)	18.00 (±0.61)	2 (4%)	17.5 (±0.35)	5 (10%)	20.80 (±1.03)	1 (2%)	20.0 (±0.00)	2 (4%)	16.0 (±0.70)	14 (5.6%)	18.79 (±0.63)
Total	50	5.16 (±0.81)	50	5.08 (±0.76)	50	5.74 (±0.91)	50	4.18 (±0.74)	50	4.1 (±0.69)	250	4.80 (±0.35)

*Standard error present.
c.s Certification standard.

Table 6: Percent germination count of rice seed samples collected from five hill districts of Manipur.

Seed germination range (%)	*Hill Districts*											
	Churachandpur		*Chandel*		*Senapati*		*Ukhrul*		*Tamenglong*		*Total*	
	Occurrence (%)	*Mean% (±s.e)**	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*
90-100%	43(86%)	95.85	9(18%)	93.84	4 (8%)	92.14	1 (2%)	92.33	2 (4%)	91.79	59 (23.6%)	95.16
(c.s)		(±0.37)		(±0.91)		(±0.34)		(±0.00)		(±0.32)		(±0.35)
80-90%	6 (12%)	87.41	14 (28%)	85.37	9 (18%)	86.30	16 (32%)	84.15	13 (26%)	85.02	58 (23.2%)	85.31
		(±1.08)		(±0.92)		(±0.87)		(±0.72)		(±0.74)		(±0.41)
70-80%	1 (2%)	78.23	13 (26%)	75.93	9 (18%)	74.64	10 (20%)	74.52	11 (22%)	72.52	44 (17.6%)	74.55
		(± 0.00)		(±0.77)		(±1.03)		(±0.86)		(±0.63)		(±0.45)
60-70%	0.00	0.00	5 (10%)	64.98	16 (32%)	65.49	11 (22%)	63.58	12 (24%)	63.73	44 (17.6%)	65.16
				(±1.07)		(±0.87)		(±0.63)		(±0.70)		(±0.86)
50-60%	0.00	0.00	7 (14%)	55.36	11 (22%)	54.80	9 (18%)	53.88	6 (12%)	55.18	33 (13.2%)	54.73
				(±0.93)		(±0.76)		(±0.59)		(±1.00)		(±0.42)
< 50%	0.00	0.00	2 (4%)	44.99	1 (2%)	49.37	3 (6%)	48.25	6 (12%)	48.12	12 (4.8%)	48.40
				(±0.23)		(±0.00)		(±0.10)		(±0.42)		(±0.25)
Total	50	5.16 (±0.81)	50	76.75 (±1.97)	50	70.34 (±1.83)	50	70.84 (±1.92)	50	69.42 (±1.90)	250	76.26 (±0.97)

*Standard error present.
c.s Certification standard.

Churachandpur had the highest occurrence (32%) in the lowest range while the lowest (8%) was with Tamenglong succeeded by Ukhrul (20%), Senapati (24%) and Chandel (28%) districts, respectively. Chandel had the lowest (3.11% ± 0.22) mean inert matter content while the highest was with Tamenglong (4.96% ± 0.35) followed by Ukhrul (4.11 ± 0.35), Churachandpur (3.54% ± 0.29) and Senapati (3.54 ± 0.29) respectively. Among the farmers, seed crops were undifferentiated from grain crops but separated as a part of the latter. A high level of inert matter content in all the samples (77.60%) with >2% inert matter content can be attributed to the non-use of seed processing practices other than manual threshing and winnowing as in grain crops. Narayanaswamy *et al*. (1996) reported that only 54% of seed samples of groundnut could meet the inert matter standard for seed certification. Chandel district had lower inert matter content compared to other districts.

The proportion of weed seed-free samples conforming to the certification standard was 35.2% (Table 5). The proportions respective with their per 40g of seed were 1 to 5 (29.2%), 5 to 10 (16.4%), 10 to 15 (13.6%) and >15 (5.6%), respectively. The overall mean content of total weed seed in the samples of the whole hill was 4.80% ± 0.35. Among the districts, Ukhrul districts had the highest proportion of weed seed-free samples (46%) followed by Tamenglong (38%), Churachandpur (36%), Chandel (28%), and Senapati (28%). The high proportion of weed-contaminated seeds beyond the certification limit (Table 5) indicated the poor level of seed quality being used by the farmers as well as improper cultural practices during the growing period. Many of the samples tested (32.2%) were within the permissible level of weed seeds (0 nos./kg. of seeds). The presence of weed seeds at the time of crop harvest leads to the mixing of weed seeds with crop seeds, since there is no processing practice like sieving to separate the weed seeds, might be difficult to separate only by mere winnowing as they have similar specific gravity. According to Sharma *et al*. (1986), weeding is more expedient and sometimes the entire crop fails, if it is not done effectively. Wedding contamination is one of the most important causes of low productivity of rice in uplands.

As for seed germination of the pure seeds (Table 6) altogether only 46.8% could conform to the certification standard (80–100%). The seed germination range having the highest occurrence (23.6%) was in the range 90 to 100% followed by 80 to 90% (23.2%), 70 to 80% (17.6%), 60 to 70% (17.6%), 50 to 60% (13.2%) and < 50% (4.8%). Among the districts, the highest germination rate was found in the seeds collected from Churachandpur showing all above 75% with a mean of 94.48% ± 0.62 followed by Chandel (76.75% ± 1.97), Ukhrul (70.84% ± 1.92), Senapati (70.34% ± 1.83) and Tamenglong (69.42% ± 1.90), respectively. Churachandpur district had the highest occurrence of 98% of the samples conforming to the certification standard (80-90%), followed by Chandel (46%), Senapati (26%), Ukhrul (17%) and Tamenglong (15%), respectively. The lowest class of < 50% was found in 6 (12%) samples of Tamenglong, 3 (6%) of Ukhrul, 2 (4%) of Chandel and 1 (2%) of Senapati (Table 6).

The poor seed germination level (Table 6) 46.8% of the sample conformed to the certification standard. Traditionally

Table 7: Moisture contents rice seed samples collected from five hill districts of Manipur(in percent).

Seed moisture content range (%)	*Hill Districts*											
	Churachandpur		*Chandel*		*Senapati*		*Ukhrul*		*Tamenglong*		*Total*	
	Occurrence (%)	*Mean% (±s.e)**	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*	*Occurrence (%)*	*Mean% (±s.e)*
< 12%	16(32%)	10.83 (±0.28)	7 (14%)	11.03 (±0.23)	3 (6%)	11.79 (±0.07)	3 (6%)	11.41 (±0.17)	2 (4%)	11.56 (±0.09)	31 (12.4%)	11.07 (±0.17)
12-13%	13 (26%)	12.81 (±0.16)	12 (24%)	12.37 (±0.06)	14 (28%)	12.58 (±0.08)	16 (32%)	12.55 (±0.05)	10 (20%)	12.66 (±0.08)	65 (26%)	12.51 (±0.33)
13-14%	8 (16%)	13.48 (± 0.08)	20 (40%)	13.61 (±0.05)	21 (42%)	13.66 (±0.03)	18 (36%)	13.64 (±0.06)	19 (38%)	13.37 (±0.06)	86 (34.4%)	13.52 (±0.02)
> 14%	13 (26%)	15.08 (±0.26)	11 (22%)	14.85 (±0.18)	12 (24%)	15.07 (±0.22)	13 (26%)	14.62 (±0.23)	19 (38%)	14.80 (±0.14)	68 (27.2%)	14.88 (±0.09)
Total	50	12.77 (±0.26)	50	13.22 (±1.84)	50	13.58 (±0.16)	50	13.41 (±0.15)	50	14.80 (±0.00)	250	13.32 (±0.08)

*Standard error present.

farmers in this region store the seeds in kotlus, gunny bags, bamboo mats, mud-pastured storage structures, and even in tins and drums. The ultimate object of testing for germination is to gain information with respect to the field planting value of the seed and to provide results that can be compared to the value of different seed lots (Natesan and Manonmani, 2001).

With respect to the seed moisture content (Table 7), 27.2% of the sample collected had a higher level than the permissible (13%) of the certification standard, while 12.4% were in the safe level for storage (< 12%). Among the districts, Tamenglong had the maximum number of samples{76% (38 + 38%)} with excess moisture content followed by Senapati{66% (42 + 24%)}, Chandel {62% (40 + 22%)}, Ukhrul{62% (36 + 26%)} and Churachandpur{42% (16 + 26%)}, respectively. The overall highest occurring moisture content range was 13 to 14% (34.4%) followed by > 14% (27.2%). The high seed moisture content (Table 7) may be attributed to the high humidity prevailing throughout the year in the hill districts of the state. The amount of moisture in the seeds is probably the most important factor influencing seed viability during storage. Prasad *et al*.(1986) found that storage should be done when the moisture content is down to about 12%. Churachandpur district had the lowest moisture content (< 13%) with the highest seed germination (94.48%), Tamenglong had the highest moisture content (>14%), and the lowest seed germination (69.42%).

The above overall quality levels in Table 8 have clearly shown the low-quality levels of the seeds being used in the five hill districts of Manipur. The highest quality levels were found in the Chandel district. Out of the 250 seed samples analyzed, only one sample from Chandel district could meet the Indian minimum seed standard for certification with regard to different quality components. Use of poor quality local seeds by the hill farmers, due to unavailability of the certified or quality seed can be an important contributing factor to the lower level of crop yield recorded in the hill districts.

Although upland rice is cultivated in about 1.5 million hectares, the productivity continues to remain very low as compared to irrigated rice (Lal,1986). The reason for the low yield of upland rice may be attributed to local germplasm/ landraces used by the farmers, which are generally tall, long duration and low-yielding types. The National Seed Corporation has been undertaking the production of certified seeds to the tune of 0.4 to 0.45 million tons/year. However, the seed replacement rate among Indian farmers is very low. The Indian farmers use their own seeds. The replacement rate in wheat, rice, and pulses is around 10% only. In other words, the organized seeds industry caters to the need of 10% of seed requirement and the remaining 90% of the requirement is met by farmers from their own saved seed (Sharma, 1994).

Rai and Tomar (1994) stated that in spite of a sound footing in the initial years, the seed sector in India has failed to maintain its pace of growth over the years. The success of a high-yielding variety program depends much upon the continuous replacement of deteriorated seeds at farmers' fields by certified or quality seeds. However, there has been only marginal improvement in replacement over the years. The situation is much more discouraging among the hill farmers due to their lack of awareness as well as the unavailability of quality seeds.

Studies made at the farmers' level in other Indian states have also revealed the general lack of awareness of seed quality among the farmers. Prasad *et al*.(1994) suggested extensive programs for educating farmers to use better-quality seeds. Dahiya *et al*.(1998) suggested that the Indian seed industry needs to critically analyze the lessons for low seed replacement rates and take steps for quality assurance,

Table 8: Conformity of the rice seed samples with respect to the different components of seed certification standards.

Districts	*Number of samples conforming with*							
	Purity	*M.C**	*Germ.***	*Purity & M.C.*	*Purity & Germ.*	*M.C. & Germ.*	*Purity,M.C. & Germ.*	*No. of samples tested*
Churachandpur	1	29	49	0.00	1	27	0.00	50
Chandel	3	19	23	2	1	20	1	50
Senapati	1	17	13	1	0.00	4	0.00	50
Ukhrul	1	19	17	1	0.00	12	0.00	50
Tamenglong	0.00	12	15	0.00	0.00	8	0.00	50
Total Manipur Hill	6	96	117	4	2	71	1	250

*M.C. – Seed Moisture Content
** Germ.- Germination

low cost, and easy and timely availability of quality seeds to the farmers.

Katiyar and Vaish (1998) emphasized the need for extension work to educate farmers on prescribed methods of seed production, roughing, better storage, and quick replacement of seed. Ujjinaaiah *et al*. (1998) reported that the majority of Karnataka farmers use their own seeds and do not test for seed germination, purity and vigor before sowing and there is a need to create awareness among the farmers about the knowledge of seed quality. Vig and Sharma (1998) also made the same suggestion for the farmers of Punjab.

The area where urgent attention is needed is to establish a firm link between the seed industry and the farmers through quality seeds. The seed industry must provide quality seeds of desired varieties at the right time and cost. On the other hand, the farmers must be aware and ready for the introduction of quality seed for higher production. The need for farmers' education is much more needed for areas, such as the present study site, where crop production is severely affected due to the ignorance of farmers and the unavailability of basic inputs like quality seed. There is an urgent need to educate the farmers about the importance and advantages of using good quality certified seeds of HYV in rice.

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