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PHYSICAL QUALITY CHARACTERISTICS OF WHEAT AT FARMGATE AND PROCUREMENT CENTRES IN PUNJAB AND COMPARISON WITH FAIR AVERAGE QUALITY SPECIFICATIONS

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The quality characteristics of Punjab wheat assessed through two surveys, conducted in 1988 and 1989 harvest seasons, revealed that the mean percentage of total foreign matter, moisture content, unthreshed, weeviled, broken and other food grain were 1.27, 8.28, 0.24, 0.05, 1.6 and 1.32 in 1988 and 1.62, 7.66, 0.39, 0.09, 1.43 and 1.69 in 1989 respectively. A substantial number of samples did not meet the F.A.Q. (fair average quality) specifications of Pakistani wheat. The mean insect density in samples containing insects was 2.3/kg and 3.7/kg in 1988 and 1989 respectively which comprised of 6 stored grain insect species.

Key words: Wheat, Physical quality characteristics.

Introduction

Wheat is the major food crop of Pakistan with an annual estimated production of about 15 million tons of which Punjab produces about 10.5 million tons. Government procures about 30% of the total production for which temporary procurement centres are established throughout the province. The food handling agencies issue their procurement policy each year which includes quality specifications for the wheat to be procured. However, specified procurement procedures are not often strictly followed and as a consequence poor quality wheat is purchased. Wheat quality largely determines the storability, i.e. the degree of deterioration during storage, besides influencing the milling and baking quality of grain [1]. Sinha *et al.* [2], Gupta and Pingale [3] and Doharey *et al.* [4] examined the wheat quality characteristics and their effect on storability of grain. Girish *et al.* [5] investigated the quality of wheat available for procurement in East Punjab and other provinces of India.

In the present study, wheat quality was assessed through two surveys conducted in 1988 and 1989 to obtain a fair idea of the quality of Punjab wheat. The primary purpose of the surveys was to compare the physical quality characteristics at procurement centre and farmgate level. In addition, the surveys were meant to make an independent assessment of wheat procured by government in two growing seasons, providing a basis for comparison with FAQ (fair average quality) specifications. Besides, determining the physical quality of wheat the occurrence of insects in wheat samples was also examined.

Materials and Methods

Surveys and sampling. The surveys were conducted in all the districts of Punjab during 1988 and 1989 harvesting seasons. A total of 336 samples were collected in 1988 while 172 samples were gathered in 1989. Each sample (about 1.5 kg) was kept in a polyethylene bag and sealed for analysis in laboratory. The number of samples collected from various districts were proportionate to their wheat production. In the first survey (1988), 37.4% of the samples came from farmgate and 62.6% from the government procurement centres, while in the second survey 63.4% and 36.6% samples were collected from farmgate and procurement centres respectively.

Analytical procedures. The collected samples were analysed within a week in laboratory. The entire sample was sieved, using standard sieves in order to remove dust and dockage (straw, weed seed and piece of plants excluding other food grains) which together constituted foreign matter [5]. Dockage and dust were weighed separately. The sieving also resulted in separation of live and dead stored grain insects which were identified and counted.

The moisture content of the samples was measured using a Burrows digital-700 moisture computer. The hectoliter weight was ascertained by chondrometer.

The sample was subsequently divided by a riffle type divider to obtain a workable sub-sample weighing 25-40 g. The unthreshed, weeviled insect damaged, broken and other food grains were separated manually, weighed and their percentage was calculated.

Results and Discussions

Comparison of wheat quality in 1988 and 1989 samples. The percentage of dockage, broken and other food grains did not differ significantly for the two years (Table 1). This is because the harvesting techniques that generally influence these factors [6] did not change remarkably. The mean percentage of dust and total foreign matter, however, were significantly higher in 1989 samples over that of 1988 samples

($p<0.05$). This may presumably be due to lesser rainfall at the time of harvest in former and thus there were more frequent dust bowls in the wheat growing areas which consequently added higher amount of dust in wheat piles at the time of threshing and transportation. The moisture content was found to be significantly lower ($p<0.001$) in 1989 also due to the meagre rainfall at harvesting time. The percentage of unthreshed and weeviled grains were significantly higher in 1989 compared to that in 1988 ($p<0.001$ and $p<0.05$ respectively) suggesting slightly poor quality of wheat in 1989 with respect to these attributes. The hectolitre weight was however, significantly higher in the later year ($p<0.05$). The overall picture of the two data sets regarding physical quality of wheat using Hotelling T statistic shows no significant difference.

Comparison of wheat quality with FAQ specifications. Table 2 compares the wheat quality characteristics of the survey samples with the FAQ specifications of Punjab Food Department. With respect to total foreign matter 51.5 and 52.3 % of samples exceeded the rejection limit in 1988 and 1989 surveys respectively. Weevilization of wheat grain, though only a small fraction was found in 30.9 and 40.7% samples in the first and second survey respectively. Broken (damaged) grain and other food grain percentage exceeded the rejection limits in a substantial number of samples in both the surveys. However, moisture content (%) exceeded the rejection limit only in 1.8% samples in 1988 survey while it did not exceed this limit in any of the samples in 1989 presumably due to dry harvest in this year. It is noteworthy that the percentage of samples exceeding the tolerance or rejection limits with respect to difference quality attributes, with the exception of moisture content, was closely similar (non-significant) in 1988 and 1989 surveys.

Comparison of wheat quality at farmgate and procurement centres. Moisture content, unthreshed and other food grains were higher in wheat samples collected from farmgate compared to that obtained from procurement centres in both the years ($p<0.05$) (Table 1), while weeviled grain percentage was higher at procurement centres than at farmgate ($p<0.05$). The reason for lower moisture content at procurement centres is that the wheat loses some moisture during the time of span between harvest to wheat collection at the procurement centres. Normally the procurement is being done after some cleaning and sieving the grain to meet the FAQ specifications hence other food grain percentage was consistently lower at the procurement centres. When the grain is kept here for some days without any treatment, the weevilization process continues unabated. Therefore, it is advisable that wheat should not be kept at procurement centres for any sizable length of time.

TABLE 1. COMPARISON OF QUALITY CHARACTERISTICS OF WHEAT SAMPLES OF FARMGATE AND PROCUREMENT CENTRES COLLECTED FROM PUNJAB IN 1988-89 SURVEYS.

Quality attributes	Source	1988		1989	
		Mean	SE ±	Mean	SE ±
Dockage %	Farmgate	1.14	0.18	1.58	0.20
	Pr. centre	1.26	0.11	1.43	0.20
	Overall	1.22	0.09	1.52	0.15
Dust %	Farmgate	0.05	0.02	0.10	0.02
	Pr. centre	0.05	0.01	0.08	0.01
	Overall	0.05	0.01	0.09	0.02
Total F.M. %	Farmgate	1.19	0.18	1.68	0.20
	Pr. centre	1.32	0.11	1.52	0.20
	Overall	1.27	0.09	1.62	0.15
Moisture	Farmgate	8.44	0.09	7.67	0.07
content %	Pr. centre	8.18	0.04	7.63	0.10
	Overall	8.28	0.04	7.66	0.06
Hectolitre	Farmgate	76.79	0.22	77.60	0.30
wt.kg/HI	Pr. centre	77.20	0.11	77.35	0.23
	Overall	77.05	0.11	77.51	0.21
Unthreshed %	Farmgate	0.28	0.03	0.43	0.41
	Pr. centre	0.21	0.02	0.32	0.05
	Overall	0.24	0.02	0.39	0.03
Weeviled %	Farmgate	0.02	0.00	0.06	0.01
	Pr. centre	0.07	0.01	0.05	0.03
	Overall	0.05	0.00	0.09	0.01
Broken %	Farmgate	1.87	0.21	1.27	0.20
	Pr. centre	1.47	0.09	1.72	0.23
	Overall	1.62	0.10	1.43	0.15
O.F. Grain %	Farmgate	1.71	0.28	1.71	0.23
	Pr. centre	1.10	0.08	1.65	0.21
	Overall	1.33	0.12	1.69	0.16

TABLE 2. NUMBER AND PERCENTAGE OF WHEAT SAMPLES WITH QUALITY PARAMETER VALUES NOT MEETING THE FAQ TOLERANCE AND REJECTION LIMITS.

Quality attributes	FAQ Specification limits*	1988 Samples		1989 Samples	
		No. of samples	Percentage of total**	No. of samples	Percentage of total**
Total foreign matter	T upto 0.5%	86	25.6	43	25
	R over 1.0%	173	51.5	90	52.3
Other food grain	T upto 3.0%	21	6.2	16	9.3
	R over 5.0%	17	5.1	13	7.6
Damaged (broken)	T upto 3.0%	39	11.6	16	9.3
	R over 5.0%	19	5.6	8	4.7
Weeviled (insect damaged)	T nil	104	30.9	70	40.7
Moisture content	T upto 10%	8	2.4	0	0
	R over 11%	6	1.8	0	0

* Specifications of Punjab Food Department except moisture content limits which are included only in PASSCO (Pakistan Agricultural Services & Supplies Corporation) specification.; ** Total number of samples in 1988 survey = 336, 1989 survey = 172.
T = Tolerance limit; R = Rejection limit

Occurrence of insects in wheat samples. The analysis of samples collected during 1988 survey showed that 7.1% of the total samples contained insects, out of which 6.0% had alive insects while 1.1% contained dead insects. The mean insect density in the samples containing insects was 2.3/kg. The relative composition of various insect species present in infested wheat samples of 1988 is given in Table 3. *Rhizopertha dominica* was the dominent species (69.2%) followed by *Trogoderma granarium* (23.1%). Whereas, in 1989 survey 15.1% of the total samples were found to contain insects; 8.7% contained alive, 1.2% dead and 5.2% contained both alive and dead insects. The mean density of insects in the infested samples was 3.7/kg. Their relative composition is shown in Table 3. As opposed to 1988, in the 1989 samples the dominant species was *T. granarium* followed by *R. dominica.*

In the first survey, infestation was found only in wheat collected from procurement centres while in the second survey, 28.6% of the samples from procurement centres were found infested and only 7.3% of the samples collected from farmgate contained insects. At procurement centres the dominant species was *T. granarium* followed by *R. dominica*, while in the farmgate samples *T. granarium* was the predominent species followed by *Tribolium castaneum.*

In 1989 samples the frequency of occurrence and density of *Trogoderma granarium* not only increased at procurement centres but was also found in farmgate samples suggesting favourable humidity and temperature conditions for its population development although rainfall was lesser in this year. It is known that *T. granarium* prefers hot and humid conditions. Generally, at the initial level of insect infestation, the grain quality does not exhibit relationship with insect density. However, the percentage of weeviled grain seems to be directly correlated with insect density in the two survey years.

TABLE-3. PERCENTAGE COMPOSITION OF STORED GRAIN INSECT PEST SPECIES IN INFESTED WHEAT SAMPLES COLLECTED FROM PUNJAB DURING 1988-89 SURVEYS.

Insect species	1988			1989		
	Farmgate	Procurement centre	Over all	Farmgate	Procurement centre	Over all
T. granarium	0.0	23.1	23.1	76.5	46.9	52.7
R. dominica	0.0	69.2	69.2	5.9	38.3	32.7
T. castaneum	0.0	7.7	7.7	17.6	7.4	9.2
S. oryzae	0.0	0.0	0.0	0.0	4.9	4.1
L. oryzae	0.0	0.0	0.0	0.0	2.5	2.0

It is evident that a large number of samples do not meet the existing FAQ specification, therefore, following recommendations are given to improve grain quality as well as storability.

Wheat procurement should be based on scientific lines and the present procurement specifications should be revised keeping in view the extent of variation in grain quality. For this purpose new standards should be developed with incentives to farmers to sell good quality at premium price. Determination of moisture content of grain, foreign matter and sampling procedure should be performed using appropriate instruments and methods. Under no circumstances grain with live insects should be procured. The procured wheat must be immediately transported to the godowns so as to avoid contamination of insects weather- damage during temporary storage at procurement centres. Upon arrival in godowns the wheat should be fumigated without delay to preserve its quality and storability.

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