

Forty-eight per cent of the reporting groups spent less than \$30 for all items, 43 per cent spent from \$30 to \$99, and 9 per cent spent \$100 or more (Table 4).

Table 4. Distribution of groups according to expenditures for all items.

Expenditures Dollars	Number	Groups Reporting Per Cent
All Groups	1,965	100.0
Less than 10	177	9.0
10 - 19	375	19.1
20 - 29	399	20.3
30 - 39	324	16.4
40 - 49	187	9.5
50 - 74	231	11.8
75 - 99	93	4.7
100 - 149	75	3.8
150 - 199	41	2.1
200 - 299	21	1.1
300 - 399	11	.6
400 - 499	7	.4
500 and over	24	1.2

The 1965 nonresident tourist groups represented only a small proportion of the total number of nonresidents traveling in North Dakota during the season. The total expenditures by nonresident tourists amount to millions of dollars each year, indicating that tourism is a very important industry in North Dakota. These expenditures benefit the immediate recipient and are diffused throughout the community.



Figure 1. Disaster strikes. Hail causes some \$3,000,000 of damage annually to North Dakota's wheat crop.

Simulated Hail Damage On Spring Wheat

Robert H. Busch

Hail losses to wheat causes yield decrease and other damage amounting to about \$3,000,000 annually in North Dakota. Uninsured hail damage decreases farm income in North Dakota by possibly as much as another \$3,000,000.

Insurance against hail losses is written by private companies and public programs. Hail adjustors "adjust" hail losses on hundreds of farms in North Dakota each year. Estimating hail damage is difficult, but efforts to improve the accuracy of hail damage adjustment techniques have been underway for many years and continue as varieties change, research techniques improve, and more knowledge is gained. North Dakota State University is participating in this research.

Insurance companies have founded a research organization called Hail Insurance Adjustment and Research Association (HIARA) to obtain accurate measurements of various damage levels and their effect on yield and other characteristics on many insured crops. Winter wheat has been studied at several state experiment stations, using various treatments in five stages of growth: boot, bloom, milk, soft dough and hard dough. Appropriate yield adjustments for damage have been incorporated into a hail loss chart for use throughout the western plains wheat area. Further experimentation is necessary to confirm and combine various levels of damage to more accurately assess the reduction in yield and yield components in spring wheat.

Research was begun in 1968 by the Agronomy Department and funded by HIARA to conduct simulated hail injury studies on hard red spring wheat at the Fargo, Carrington and Dickinson

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Agricultural Experiment Stations in North Dakota. Hail damage is simulated by breaking the wheat stems above and below the flag leaf with varying intensities of damage in five stages of growth: boot, bloom, milk, soft dough and hard dough. Yield, kernel weight, test weight, kernels per head and per cent fallen spikes are measured for each treatment and compared to undamaged wheat grown in the same trial.

Some general trends are noted from the several locations of trials grown in 1968. Above flag leaf treatments applied in the bloom stage reduced yield most severely. Treatments applied higher on the stem (closer to the heads) reduced yield more severely than breaks lower on the stem in all stages of growth. Probably the major cause in loss of yield for damage inflicted below the flag leaf was due to heads being lower than the cutter bar of the harvester. Test weight and kernel weight were reduced most severely by damage applied in the milk stage. Damage inflicted above the flag leaf caused more severe reductions in kernel weight and test weight than damage inflicted below the flag leaf. More fallen spikes occurred when

damage was inflicted near the head than when damage was inflicted below the flag leaf, probably due to the effect of the wind, causing this type of damaged plants to drop their grain filled heads.

This type of study must be continued for several more years to accurately ascertain the best loss estimates in an average environment at the various locations in North Dakota.

Acknowledgment

The Department of Agronomy, Agricultural Experiment Station, North Dakota State University, Fargo, gratefully acknowledges a grant of \$5,000 in 1968 from the Hail Insurance and Adjustment Association to support this research on simulated hail injury to hard red spring wheat. The Association has made a grant of \$5500 in 1969 to continue the research.

Staff members of several departments of the College of Agriculture, NDSU, also cooperate with HIARA in teaching a 2-day Spring Wheat Workshop to insurance adjustors and company personnel in June, 1967, 1968 and 1969, to teach the insurance personnel more about wheat.



Figure 2. Below flag leaf simulated hail damage to spring wheat.



Figure 3. Above flag leaf simulated damage to spring wheat.