Table 2

Treatment	Total cells	Total cores	Single cores	Single cores (per cent)	Total cores per cell
After 28½ hr. heat	19	36	11	30	1·9
After 52½ hr. heat	10	21	8	38	2·1
After 76½ hr. heat, and 14 days recovery	19	60	5	8	3·2
Same, but 19 days recovery	8	25	10	40	3·1

tri-, penta-, and hepta-partite cores in the spermatids of certain insects. While their photographs leave no room for doubt, could not the existence of cores in these insects be a very interesting anomaly? Research on haploid and triploid forms and on strains carrying multiple inversions should settle this point.

The recent work of Charard[9] also agrees with the interpretation of Moses and our interpretation.

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[1] Sax, Karl, *Amer. J. Bot.*, **24**, 218 (1937).
[2] Nebel, B. R., *Rad. Res.*, Supp. 1, 431 (1959).
[3] Moses, M. J., *J. Biophys. Biochem. Cytol.*, **2**, 215 (1956).
[4] Moses, M. J., *J. Biophys. Biochem. Cytol.*, **4**, 633 (1958).
[5] Fawcett, D. W., *J. Biophys. Biochem. Cytol.*, **2**, 403 (1956).
[6] Steinberger, E., and Dixon, W. J., *Fertility and Sterility*, **10**, 578 (1959).
[7] Kaufmann, B. P., Gay, H., and McDonald, M. R., *Int. Rev. Cytol.*, **9**, 77 (1960).
[8] Sotelo, R. J., and Trujillo-Cenóz, O., *Z. Zellforschung*, **51**, 243 (1960).
[9] Charard, R., *C.R. Acad. Sci., Paris*, **249**, 1386 (1959).

GENETICS

Effect of Induced Awn Mutations on Yield in Wheat

From comparisons between sister lines of the same parental derivation segregating in awn character and from experiments using backcrosses, awns have been found to have a positive function as regards grain yield in varieties of bread wheat[1–3]. A spontaneous awned mutant isolated by Mackey[4] in the variety Scandia III outyielded the parent strain in trials carried out over a period of 5 years. Awns have been supposed to influence yield by increasing assimilation and transpiration and thereby the size of the grains. Fully awned mutants frequently occur when varieties belonging to the tipped 1 class of Watkins and Ellerton[5] (that is, awns 1–2 cm. in length and confined to the uppermost spikelets) are treated with both ionizing radiations and chemical mutagens[6]. Several such mutants were found by us in the M_2 progenies of the varieties *N.P.* 799 and *N.P.* 809 treated with phosphorus-32 and sulphur-35 (both 5 μc. per seed), X-rays (16,000 and 22,000 r.) and different dosages of fast and thermal neutrons. Both these varieties have the dominant epistatic gene *B1* on chromosome 5*A* (nomenclature of Sears[7]) and the established awn mutations behaved as monogenic changes in genetic studies. The mutants had the somatic chromosome number 42 and no prominent change could be detected in their karyotypes.

Twenty-five awned mutants of *N.P.* 799 and six such mutants of *N.P.* 809 were grown in replicated rod-row trials during 1958. All the awned mutants of *N.P.* 799 yielded more than the parent strain, while in *N.P.* 809 some yielded better and some lower. In both the varieties, the mutants found to be most promising in the first trial maintained their superiority in trials conducted during subsequent years. The yield of these awned mutants is indicated in relation to that of the parents in Tables 1*a* and *b*.

Table 1. Relative Grain Yield of Awned Mutants

(*a*) *N.P.* 799

Trial conducted at :	Awned mutant	Yield (percentage of control) 1958–59	1959–60
New Delhi	799–25	120·11*	109·52*
	799–6	110·00*	103·17
Pusa (Bihar)	799–25	110·85*	104·49
	799–6	102·21	104·24

(*b*) *N.P.* 809

Trial conducted at :	Awned mutant	Yield (percentage of control) 1957–58	1958–59	1959–60
New Delhi	809–1	126·14*	111·12*	102·14
	809–6	106·43*	106·06*	—
	809–9	104·12	—	—
Simla (Himachal Pradesh)	809–6	—	110·68*	—
	809–9	—	106·10	—
Karnal (Panjab)	809–6	—	—	100·86

* Significantly higher.

The awned mutants of *N.P.* 799 and *N.P.* 809, the performance of which in yield trials is given in Tables 1*a* and *b*, resembled the parents in all other characteristics like maturity period, shape and quality of grain and rust resistance. Thus the increased yielding ability of some of them could be due to the addition of awns. Vervelde[2] has shown that in warm and dry areas awns play a particularly important part in grain production.

In the plains of India, awned wheats are liked by the farmer since they are damaged less by birds and hence the fully awned mutants of *N.P.* 799 and *N.P.* 809 have a double advantage, that is, they help to satisfy the needs of the farmer and to enhance the yield of the strain. *N.P.* 799–25, an awned mutant which has performed well in the yield trials conducted until now, has been named *N.P.* 836, and it will be tested in larger trials during the coming years.

Of late, there has been much scepticism concerning the possibility of adding through mutation breeding a desirable trait alone to an established variety without simultaneously bringing about some undesirable changes. The agronomic qualities of the fully awned mutants reported in this communication would suggest that in polyploids like bread wheat, which readily withstand whole and part-chromosome deletions, mutation breeding may have considerable scope, particularly if the deletion of a dominant epistatic locus has a favourable effect.

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[1] Miller, E. C. Gauch, H. G., and Gries, G. A., *Kansas. Agric. Exp. Sta. Tech. Bull.*, **57**, 82 (1944).
[2] Vervelde, G. J. *Netherlands J. Agric. Sci.*, **1**, 2 (1953).
[3] Suneson, C. A., Bayles, B. B., and Fifield, C. C., *U.S. Dept. Agric. Circ.* No. 783 (1948).
[4] Mackey, J., *Hereditas*, **40**, 65 (1954).
[5] Watkins, A. E., and Ellerton, S., *J. Genet.*, **40**, 243 (1940).
[6] Natarajan, A. T., Sikka, S. M., and Swaminathan, M. S., *Proc. Second Int. Conf. Peaceful Uses Atom. Energy, Geneva*, **27**, 321 (1958).
[7] Sears, E. R., *Proc. First Int. Wheat Genet. Symp. Winnipeg*, 221 (1959).