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EFFECTS OF SEED VIGOUR ON SEED PRODUCTION
AND QUALITY IN ZEA MAYS L. CV. ILLINI GOLD

BY

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**EFFECTS OF SEED VIGOUR ON SEED PRODUCTION
AND QUALITY IN ZEA MAYS L. CV. ILLINI GOLD**

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ABSTRACT

MASHAURI, I.M (1993). EFFECTS OF SEED VIGOUR ON SEED PRODUCTION AND QUALITY
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SUPERVISORS: Professor John G. Hampton, Mrs Karen Hill and Mr Allan K. Hardacre

Some of the consequences of seed deterioration can be a reduction in field emergence and stand establishment, retarded plant growth and reduced seed yield. From the available literature it is not clear whether the reported lower seed yields are solely a consequence of lower population density resulting from low vigour seed and hence poor emergence, or are a result of poor individual performance of plants grown from low vigour seed.

Two high vigour seed lots of shrunken-2 super sweet corn (*Zea mays* L.) cv. Illini Gold were artificially aged to obtain differential vigour levels (high and low vigour seed lots). These seed lots were then used to study the effects of seed vigour on field emergence and emergence rate, vegetative and reproductive growth and development, and seed yield and quality. The quality of unaged and aged seed lots was judged by the use of standard germination, health and vigour tests. This last category included seedling growth and evaluation tests, eg seedling growth test; stress tests, eg cold germination, soil cold test, complex stress vigour test (CSVT) and soak germination test; and biochemical tests, eg electroconductivity, respiration and tetrazolium tests.

The two high vigour seed lots differed significantly ($P < 0.05$) in thousand seed weight and mechanical damage levels, but not in their germination and vigour performance. However, both these seed lots were heavily infected by *Fusarium subglutinans*. The internally-borne *Fusarium subglutinans* survived the high temperature employed during the artificial ageing treatment, and was able to cause severe damage in the deteriorated seed lots. Aged seed lots demonstrated a decrease in germination and vigour as illustrated by a slower rate of seedling growth and accumulation of dry weight, an increase in electroconductivity leakage, a decrease in respiratory oxygen uptake and an increase in respiratory quotients. Interestingly, however, the performance of these seed lots in the soil cold test, cold germination test, and low temperature respiration test, did not differ significantly from that of the unaged seed lots, presumably because the activity of the seed-borne *Fusarium subglutinans* was reduced by low temperature (10°C or less). This cultivar

has some cold tolerance and exposing seed lots to low temperature did not cause the extent of physiological disorder expected, possibly because of adaptive protection mechanisms that allowed the seeds to undertake some cellular repair.

Field emergence and emergence rates were poor but did not differ significantly between high and low vigour seed lots over three spring sowings at the same site, probably because the environment exerted little stress, but more probably because the effects of both seed-borne and soil-borne *Fusarium* spp on chemically untreated seeds masked any other seed quality differences. As a consequence, no seed quality test was significantly related to field emergence, with the exception of the CSVT which was significantly ($P < 0.05$) correlated with field emergence for the November sowing. A greater ($P < 0.05$) loss of plants from low vigour seed lots due to post emergence damping-off and seedling blight caused by seed-borne and soil-borne pathogens was recorded in the October and December sowings, with the result that plant population was significantly reduced when compared to that of high vigour lots. While the reason for this increased loss was not explained conclusively, it is possible that seedlings produced from low vigour seeds were less able to withstand the fungal attack. However, in plants which survived there were no differences in heterotrophic plant growth as demonstrated by similarities in leaf, stem and plant dry weight at the 3rd leaf stage for all seed lots within any one sowing date. Significant sowing date effects were recorded, however, during autotrophic growth (5th leaf stage), the performance of high vigour seed lots (measured as leaf, stem and plant dry weight) was significantly ($P < 0.05$) superior to that of low vigour seed lots. However, these differences decreased as the plants grew and were no longer present at the 7th leaf stage, because plants from low vigour seed lots had produced thicker tillers.

From silking on, no significant differences among populations were recorded as grain filling rate and days to maximum grain dry weight did not differ. However, for the two sowings (October and December) when plant population differed significantly, plants grown from the low vigour seed lots significantly ($P < 0.05$) outyielded those grown from high vigour seed lots because the former compensated for lost plants by producing more tillers and hence reproductive parts.

The seed vigour status of the parent did not affect the seed vigour of the progeny as demonstrated by similarities in seed quality, vigour and field performance among seed lots of freshly harvested seeds. However, seed quality differed with sowing date, with seed harvested from the November and December sowings having a significantly ($P < 0.05$) lower quality than that from the October sowing. These results should be treated with caution,

because seed quality from all harvests was poor, due to heavy infection of seeds by *Fusarium* species and also damage incurred during drying. The performance of the original seed lots after storage for 14 months showed that the high vigour seed lots had a significantly ($P < 0.05$) higher germinability, vigour and field performance in comparison with their pre-storage performance because the occurrence and activity of *Fusarium subglutinans* which was rampant in unstored seed lots, decrease considerably following storage. Although seed-borne pathogens also decreased in low vigour seed lots after storage, the deterioration originally induced by the accelerated ageing had increased. For stored seed lots, a significant relationship existed between field emergence and both the standard germination and cold germination tests.

The results from both the laboratory tests and field trials were confounded by *Fusarium subglutinans* and other fungi. This work should be repeated in the absence of particularly seed-borne pathogens before any definite conclusions can be drawn.

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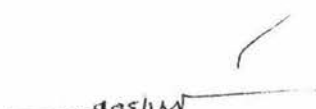

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