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1) Effects of seed color on seed deterioration.

It has been noted (Dassou and Kueneman, 1984) that soybean varieties with colored seed frequently show tolerance to seed deterioration. In Brazil, naturally occurring, colored-seeded mutants of four soybean lines have been found. The existence of these near-isolines provided an opportunity to assess the role of seed color on seed deterioration in similar genetic backgrounds.

In a preliminary study, the variety IAC-8 and its black-seeded isoline were sown on 27 December 1984 in single-row plots with four replicates at the experimental farm of Empresa Goiania de Agropecuaria, located 30 km south of Goiania, Goias, Brazil. On 18 April 1985, both lines were at physiological maturity and a sample of five to 10 plants per plot were removed and hung to dry in a ventilated shed. On the same date, 50 pods (yellow-pod stage) were subjected to incubator-weathering which mimics field weathering under humid conditions. Pods were stored at 30°C and 95% relative humidity for 7 days. Following incubator-weathering, 50 seeds from each plot were sown in an emergence test (Table 1). The seed deterioration following incubator-weathering was more drastic and the black-seeded isoline of IAC-8 had a significantly higher emergence score than that of IAC-8.

Table 1. Effect of incubator weathering on seedling emergence of yellow- and black-seeded isolines of soybean variety IAC-8, 1985

Genotype	Physiological maturity	Incubator weathering
	% emergence	
IAC-8	96.0	23.0
IAC-8 black	92.5	37.5
LSD (0.05)*	14.4	14.4

*Least significant difference.

In 1986, four pairs of isolines were evaluated for resistance to incubator-weathering and to modified accelerated aging which mimics seed deterioration in storage under ambient tropical conditions (Wien and Kueneman, 1981). Seed was stored for 6 weeks at 40°C and 75% relative humidity. Eight replicates were used to assess effects of incubator-weathering and four replicates were used for accelerated aging.

All colored-seeded isolines had significantly higher seedling emergence following incubator-weathering than their yellow-seeded versions.

Similarly, except for the pair GO 81-8181/GO 81-8181 black, colored-seeded lines were superior to their yellow-seeded versions following accelerated aging.

In the breeding program at the International Institute of Tropical Agriculture, many crosses have been made involving black-seeded cultivars from Indonesia with superior seed longevity and high-yielding varieties from the U.S. with poor seed longevity. Progenies were assessed for seed longevity in subsequent generations. Although some yellow-seeded breeding lines with excellent seed longevity have been obtained from these crosses, the majority of the breeding lines with good seed quality are colored-seeded.

The reasons why colored-seeded soybeans frequently have superior seed longevity need to be elucidated.

Table 2. Effect of seed color on seedling emergence following incubator weathering and accelerated aging, 1986

Genotype	Physiological maturity	Incubator weathering	Accelerated aging
	% emergence		
EMGOPA 301-1	95	17	9
EMGOPA 301-Brown	89	35	76
Doko	98	56	38
Doko-black	93	75	76
IAC-8	94	9	44
IAC-8-black	85	19	83
GO 81-8181	77	12	38
GO 81-8181-black	88	33	36
LSD (0.05)*	6	6	12

*Least significant difference.

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1) Varietal differences in soybeans for resistance to physical damage of seed.

Introduction: Production of quality soybean seed is frequently problematic in the tropics (Jalani et al., 1982; Khaleque, 1982; Mercer-Quarshie and Nsowah, 1975; Ndimande et al., 1981; Paschal and Ellis, 1978). In general, loss of seed vigor is associated with seed deterioration in the field prior to harvest (Ellis and Sinclair, 1976; Green and Pinnel, 1968; Ndimande et al., 1981; Paschal and Ellis, 1978; Potts et al., 1978) and with deterioration in storage (Kueneman, 1982; Minor and Paschal, 1982; Ndimande et al., 1981; Tongdee, 1982; Wien and Kueneman, 1981); seed deterioration is accelerated by hot, humid environments. While there is considerable scope for development of genotypes less prone to deterioration (Dassou and Kueneman, 1984; Kueneman, 1982, 1983; Paschal and Ellis, 1978; Wien and Kueneman, 1981), it is generally recommended that soybeans grown for seed should be sown such that they mature under dry environmental conditions. Often in the tropics, seed production must take place in the dry off-season under irrigation, which increases costs of production.

In Brazil, many seed growers have been frustrated by rejections of seed lots due to low germinability even though the seed was produced under favorable environmental conditions. Analyses of seed lots have shown that loss of vigor is often due to physical damage of seed. Physical damage to seed occurs from a series of mechanical operations beginning at harvest and occurring during seed handling until seed is sown in the subsequent season (Nave, 1980; Huynh et al., 1980); the greatest damage generally occurs at threshing. Combines with a relatively gentle threshing action have been developed (Nave, 1980) but are costly and not readily available in many developing countries. Sediyama et al. (1972) noted that variety IAC-2 was more prone to mechanical damage than 'Mineira' and 'Vicoja'. The authors know of no other studies comparing soybean varieties for resistance to physical damage.

In Brazil, seed scientists, producers, and farmers have had the impression that some varieties are more prone than others to physical damage. This study was conducted to determine if there are differences among varieties grown in central Brazil for resistance to physical damage.

Materials and methods: Eighteen soybean varieties adapted to central Brazil were sown on six dates: October 20 and 30; November 10 and 20; December 10 and 30, 1984, and again in 1985. The trial was conducted at the experimental station of Empresa Goiania de Pesquisa Agropecuaria located 30 km south of Goiania, Goias, Brazil. Plots were four rows of 6 m length. Plots were oversown and thinned to approximately 20 seedlings per m of row at 14 d after sowing. The design was a completely randomized block with four replicates, each block with 108 experimental units (18 varieties x six planting dates).

On 15 April, all varieties within a block reached physiological maturity (yellow pod stage). Late maturing varieties were at physiological maturity in earlier planting dates; earlier maturing varieties were at physiological maturity in later plantings. For each variety in each of four blocks, a sample of 200 plants was collected 21 days after physiological maturity and stored in a covered, ventilated shed until seed of all varieties equilibrated at approximately 12% moisture content. Five plants were hand-threshed and the seed sown in emergence tests to ensure that all varieties were of high quality prior to being subjected to physical stress. The remaining plants were passed through a spike-toothed vogel-type plot thresher and percentage of broken seed was determined.

Results and discussion: Percentage seedling emergence of hand-threshed seed was 90% and above for all varieties in 1984/85 (Table 1) indicating that seed entering the physical stress was of high quality. The difference among varieties for percentage of broken seed was highly significant (Table 1). 'Cristalina', 'Doko', 'EMGOPA 301', 'EMGOPA 302', and 'Bossier' had low percentages of broken seed in both years and appear to be relatively resistant to physical damage. IAC-8, IAC-2, IAC-6, UFV-1, and 'Sucupira' appear to be prone to seed damage. Varieties IAC-7, EMGOPA 303, 'Santa Rosa', 'Paranagoiana', 'Tropical', and 'Savana' appear to have intermediate susceptibility. Results were not consistent across years for varieties 'Numbaira' and 'Parana'.

Seed weights among varieties ranged from 12 to 19 g per 100 seeds and there was no clear relationship between seed size and percentage of broken seed (Table 1).

In this study, IAC-2 was one of the most susceptible varieties to physical damage. This is consistent with previous reports (Sediyama et al., 1972). With a ninefold difference between the most resistant and most susceptible varieties in this study, there appears to be great scope for selection of varieties less prone to damage. In ecologies where seed is produced under dry conditions and physical damage of seed is common, it is recommended that breeders evaluate varieties and breeding lines for resistance to physical stress and that lines with high susceptibility be discarded unless combines with gentle threshing action are available.

Table 1. Seed weight, percentage emergence of hand-threshed seed and percentage broken seed following mechanical threshing for 18 soybean lines adapted to central Brazil

Genotype	Broken seed % 1985	Broken seed % 1986	Seed weight (g/100 seed)	Emergence (%)
IAC-8	31.0	20.5	18	96
IAC-2	29.5	25.0	14	91
Numbaira	29.2	9.3	14	96
IAC-6	26.9	17.8	12	97
UFV-1	26.3	14.0	17	99
IAC-7	19.9	17.2	13	96
Sucupira	19.5	33.6	16	93
EMGOPA 303	16.8	13.7	13	95
Santa Rosa	13.6	12.9	15	95
EMGOPA 301	12.0	6.4	17	97
Paranagoiana	11.6	11.6	15	93
Tropical	9.6	18.8	15	97
Savana	7.1	14.6	16	98
Doko	6.8	8.8	15	98
Parana	6.3	22.4	13	96
EMGOPA 302	5.2	12.8	14	96
Cristalina	4.0	7.8	16	95
Bossier	3.5	12.2	19	90
LSD (0.05)*	6.6	12.2	-	7

*Least significant difference.

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