Seeds from rabi season recorded better germination than those from kharif. Differences in germination observed within large as well as small size seeds between seasons may be due to variations in material variations.

Abdalla and Vanderlipe (1972) and many other research workers reported positive association between seed size and germination. The difference in germination between G_1 and G_3 was not in proportion to that observed in seed weight between them. Therefore it becomes apparent the seed size and weight of seed are really depending upon the nutrition to mother plant whereas seed germination upon many factors of which nutrition may be one. In the present investigation germination was commparitively more in all size grades collected from the earlier than latter pickings. The early formed seeds may have the competitive advantage over the later formed ones (Hardesty and Elliot, 1956). This may be due to the environment in which the seeds developed and matured or due to the differences in the maturity of fruit at different pickings (Surilote and Rampal, 1967).

REFERENCES

ABDULA,A. and R.L.VANDERLIN. 1972. Relationships of vigour tests and seed source and size to Sorghum seedling establishment. Agron.J., 64: 143-144.

AUSTIN,P.B. and P.C.LONGDON 1965. Effect of nutritional treatments of seed bearing plants on the performance of three progeny. Nature. 205: 819-820.

CHARLES,W.B., L.Amerouche and S.Malagwi. 1979. Seedlessness in Capasicum Annuum L var. D.C. (Sendt.). J.Hort. Science. 54(2): 159-161.

HARDESTY,B. and F.ELLIOT. 1956. Differential post ripening effect among seed from the same parental wheat spine. Agron.J., 48: 9.

HODGKIN,T. 1980. Genetic aspects of seed yield and performance in horticultural hrassicar. In: Seed production (E.D.) P.D.Hebbkithwalle. Butterworths, London. pp. 535.

LONGTON,P.C. 1963. The extent, source and significance and variation in seed weight in vegetable crops. M.Sc., Thesis, University of Nottingham, U.K.

OVCHAROV,K.E. 1977.,Effect of the conditions of seed formation and storage on germination pp.7. physiological Basis of Seed Germination. Amerind Publishing Co. Pvt. Ltd., New Delhi.

RYLASKI,I. 1973. Effect of night temperature on shape and size of sweet pepper. J.Amer.Soc.Hort.Sci., 98(2): 149-152.

SURILOTE,K.M. and A.Rampal. 1967. Influence of different pickings on the quality of Americal cotton. Indian J.Agric.Sci.,37(2): 83-90.

STUDENCOVA,I. 1965. The reaction of pepper and egg plant varieties to change in day length. Hort. Abstr. 35(3): 5850.

Madras Agric. J., 33-40 January 1993

https://doi.org/10.29321/MAJ.10.A01625

PRE-TREATMENT METHODS TO CONTROL SEED DETERIORATION IN GINGELLY (*Sesamum indicum* L.) Cv. TMV 3

B.MADANAGOPAL and C.DHARMALINGAM

Gingelly seeds stored under ambient conditions in cloth bag commenced deterioration at the fourth month of storage. Pre- treatments such as i) Hydration by soaking in water for 0.5 to 8.0 h. ii) Moisture equilibration in a saturated atmosphere for 2 to 96 h and iii) Iodine permeation in an iodine saturated atmosphere for 10 to 17 h were given to 4-month-old seeds followed by drying back to their original moisture in each case. The acceleratedly aged seeds (90% RH, 40°C for 15 days) revealed that 2 h soaking-drying, 24 h moisture equilibration-drying and 12h. iodine permeation- drying effectively controlled the further deterioration in seeds and registered high germination and vigour.

Viability studies in several crop seeds have shown that a low moisture content and

1. Forms part of M.Sc (Ag) thesis in Seed Technology, Tamil Nadu Agrl. University, Coimbatore - 3

2. Professor of Seed Technology, Agrl. College and Res. Institute, Madurai.

low temperature are the major considerations for retaining good viability in the stored seeds. As such temperature and relative humidity controlled storage facilities would greatly solve theproblem of seed detrioration. But the infra- structure requirements and the high cost involved are prohibitive for large scale adoption. A practical solution would be to evolve a relatively inexpensive and easily adoptable method to maintain high level of germinability and vigour of seeds under ambient storage conditions. A mid-storage hydration-dehydration treatment was found very effective in controlling the deterioration process in a number of crop seeds (Basu, 1976; Dharmalingam and Basu 1978; Basu and Rudrapal, 1980). Therefore, standardisation of this methodology to control seed deterioration in gingelly seeds has been attempted in this investigation and results obtained are presented in this paper.

MATERIALS AND METHODS

Determining optimum time of treatment

Harvest fresh seeds of gingelly Cv. TMV 3 were dried to 4-5 per cent moisture content and stored in cloth bag under ambient temperature (26 ± 2°C) and relative humidity (65 ± 7%). Seeds were tested for germination and vigour prior to storage and subsequently at monthly and bimonthly intervals. Germination tests were made in rool-towel method using 4 x 100 seeds (Anonymous, 1976). Vigour estimations were done through growth measurements such as root and shoot lengths and dry matter production. Modified rool-towel method was adopted for vigour determination.

Determining optimum duration of treatment

Seeds were soaked in double the volume of distilled water for 0.5, 1, 2, 3, 4, 5, 6 and 8 h under room temperature. After each soaking interval, water was decanted off and the seeds were dried back to their original moisture content. The control seeds were not hydrated. Seed moisture content was estimated after each soaking interval.

b) Moisture equlibration-drying (ME-D)

In this method, the seeds were placed in a moisture saturated atmosphere obtainable in a moisture equilibration device (Basu, 1976). The seed samples were taken out after 2, 4, 8, 12, 16, 48 and 96 h and the moisture content was estimated immediately after each interval. The moisture equilibrated seeds along with the control were dried back to their original moisture by sun-drying.

C) Iodine permeation-drying (IP-D)

In this method, the seeds were placed in an atmosphere saturated with iodine vapour for slow permeation of iodine into the seeds. This was carried out as described by Basu and Rudrapal (1980). The seed samples were removed after 10, 12 and 17 h of permeation and dried along with the control seeds.

The dried seeds from each pre-treatment method were kept in a desiccator containing calcium chloride for one week to stabilise the moisture in the seed. The seeds were then dry-dressed with Bavistin (@ 2 g/kg of seed) and subjected to accelerated ageing (90 æ 1% RH and 40° ± 1°C) for 15 days adopting the procedure of woodstock and Feeley (1965). After ageing, the seeds were tested for germination and vigour potential.

Germination tests were made adopting the modified roll-towel method using 6 x 25 seeds. The germination test was maintained at 25 ± 3°C and 95 ± 3% RH and evaluated on 7th day. The normal seedlings were counted and expressed as germination percentage. The growth measurements such

Table 1. Viability and vigour of ginegelly seeds cv. TMV3 stored under ambient conditions

Months of storage	Germination (%)	Rootlength (cm)	Dry matter (mg/10 seedlings)
2	97.33 (82.31)	12.83	59.0
3	93.33 (75.20)	12.11	56.6
4	90.67 (72.29)	10.19	53.7
6	89.33 (71.01)	8.79	52.0
8	82.67 (65.43)	8.43	38.3
10	77.33 (61.59)	7.13	29.0
12	73.33 (58.96)	6.41	28.0
14	62.67 (52.34)	6.31	27.0
SED	2.56	0.34	1.49
CD	5.43**	0.72**	3.18**

(Figures in parentheses denote angular transformed values) ** Significant at 1% level

as root and shoot length, were recorded on 10 normal seedlings from each replication. The same seedlings were dried in a hot-air oven for dry matter determination and expressed as mg/10 seedlings. The vigour index (Abdul-Baki and Anderson, 1973) was computed from germination percentage and root length or seedlings in mm and expressed as a number. The data were analysed statistically adopting the suitable method.

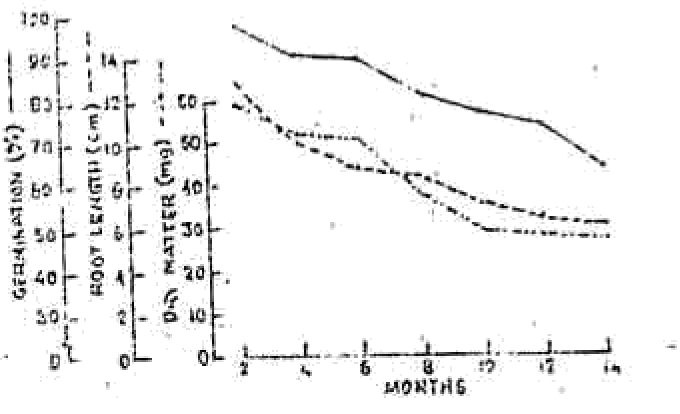

Fig.1.1

RESULTS AND DISCUSSION

The fresh seeds stored under ambient condition showed significant reduction in germination percentage (35%), root length and dry matter content (50.8 and 54.2%) in 14 month of storage. The reduction noticed at the fourth month of storage however, was 6.7, 10.5 and 9.0 per cent, respectively in germination, root length and dry matter indicating the initiation of deterioration in seeds (Table 1; Fig.1).

Evaluation of acceleratedly aged seeds following H-DH treatment showed highly significant differencess in the germination percentage among periods of soaking (Table 2, Fig.2). The seeds hydrated for 2 h recorded highest germination (69.3%) as compared to other durations of soaking. The control seeds and those hydrated below and above 2 hr recorded significantly low germination. The seedling vigour assessed through root and shoot growth measurements, dry matter content and the computed vigour index all showed significant differences among periods of soaking. The values recorded for 2 h H-DH treatment were significantly high namely, 63 mm root length, 62 mm shoot length, 31 mg dry matter and 4369 as vigour index as against 53 mm, 45 mm, 19 mg and 1627, respectively for the control seeds.

The seed moisture content showed a steep increase during the initial period of soaking upto 30 min, enhancing it from 4.4 to 23.5 per cent. Seed moisture increase was evident with the increase in soaking duration although the rate of imbibition had slowed down at the later period. An increase of about 21 per cent moisture was noted in 2 hr soaking which resulted in significantly higher

Table 2. Viability and vigour of 4 month-old gingelly seeds hydrated for varying periods and subjected to accelerated ageing at 90% RH and 40°C for 15 days.

Durations of soaking (Hr)	Germination (%)	Rootlength (cm)	Shoot length (mm)	Dry matter (mg/10 seedlings)	Vigour index	Moisture content (%)
Control	30.7 (33.62)	53.0	45.7	19	1627	4.4
0.5	44.0 (41.54)	51.3	52.3	21	2256	23.5
1	60.0 (50.78)	56.0	46.7	26	3357	24.0
2	69.3 (56.38)	63.0	62.0	31	4369	25.5
3	40.0 (39.22)	56.7	44.3	25	2269	28.2
4	50.7 (45.38)	50.3	46.0	28	2549	28.2
5	60.0 (50.78)	54.3	49.7	22	3269	30.8
6	61.3 (51.56)	53.0	43.7	23	3249	31.3
8	65.3 (53.94)	54.0	49.7	22	3231	32.4
C.D. (P=0.05)	(3.23)**	4.4**	8.9**	5.0**	417	-

(Figures in parentheses denote angular transformed values)

Vigour index = Germination % x Root length, mm

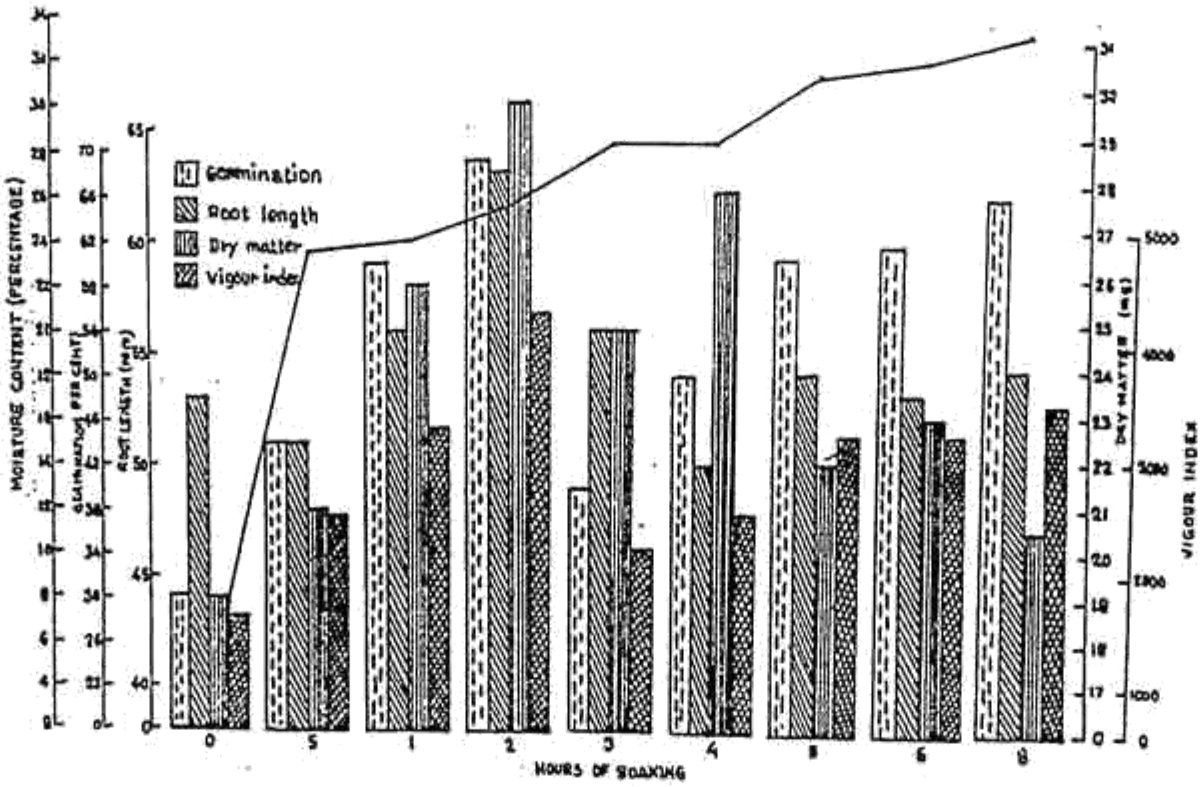

Fig.2 Hydration-Dehydration Treatments on Viability and vigour of Gingelly seeds CV. TMV 3.

Table 3. Viability and vigour of gingelly seeds moistureequilibrated - dried and subjected to accelerated ageing at 90% RH and 40°C for 15 days.

Durations of moisture equilibration (Hr)	Germination (%)	Rootlength (cm)	Shoot length (mm)	Dry matter (mg/10 seedlings)	Vigour index	Moisture content (%)
Control	28.0 (31.94)	53.0	45.1	19	1482	4.4
2	30.7 (33.56)	71.7	49.3	25	2193	5.5
4	36.0 (36.65)	63.3	55.0	23	2248	5.9
8	40.0 (39.22)	72.7	59.3	25	2701	6.1
12	45.3 (42.32)	77.0	54.7	27	3479	7.6
16	41.3 (39.78)	68.3	52.3	25	2839	9.3
24	58.0 (49.61)	87.7	63.3	30	5089	10.2
48	41.3 (40.00)	68.3	50.0	25	2820	12.4
96	28.0 (31.91)	67.0	48.3	23	1863	14.3
C.D. (P = 0.05)	(3.59)**	14.1**	5.9**	4.1**	578	-

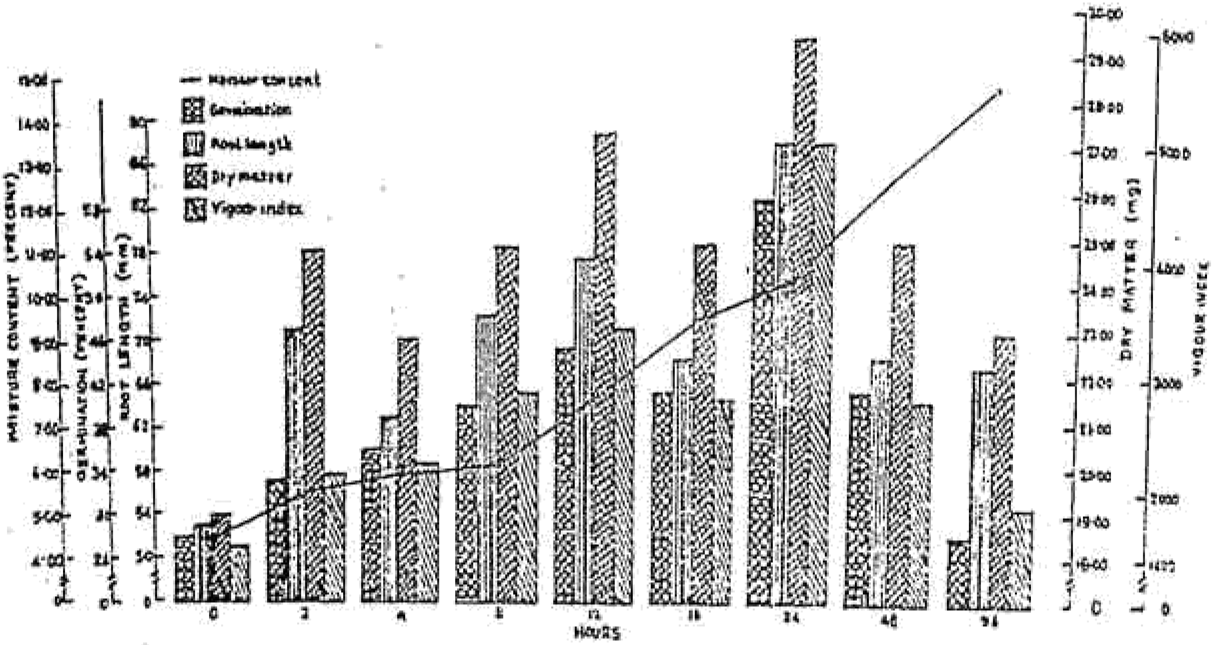

Fig.3 Effect of Moisture Equilibration of Gingelly Seeds ck TMV 3 on Viability and Vigour

Table 4. Viability and vigour of gingelly seeds with iodine vapour for varying durations and subjected to accelerated ageing at 90% RH and 40°C for 15 days.

Durations of iodine vapour permeation (Hr)	Germination (%)	Rootlength (cm)	Shoot length (mm)	Dry matter (mg/10 seedlings)	Vigour index
Control	31.0 (33.83)	71.3	61.0	25	2213
10	32.5 (34.75)	91.7	73.3	32	2984
12	37.0 (37.46)	91.7	78.3	39	3387
17	30.0 (33.20)	86.7	72.3	28	2601
C.D. (P=0.05)	(1.92)**	5.6**	NS.	2.7**	229**

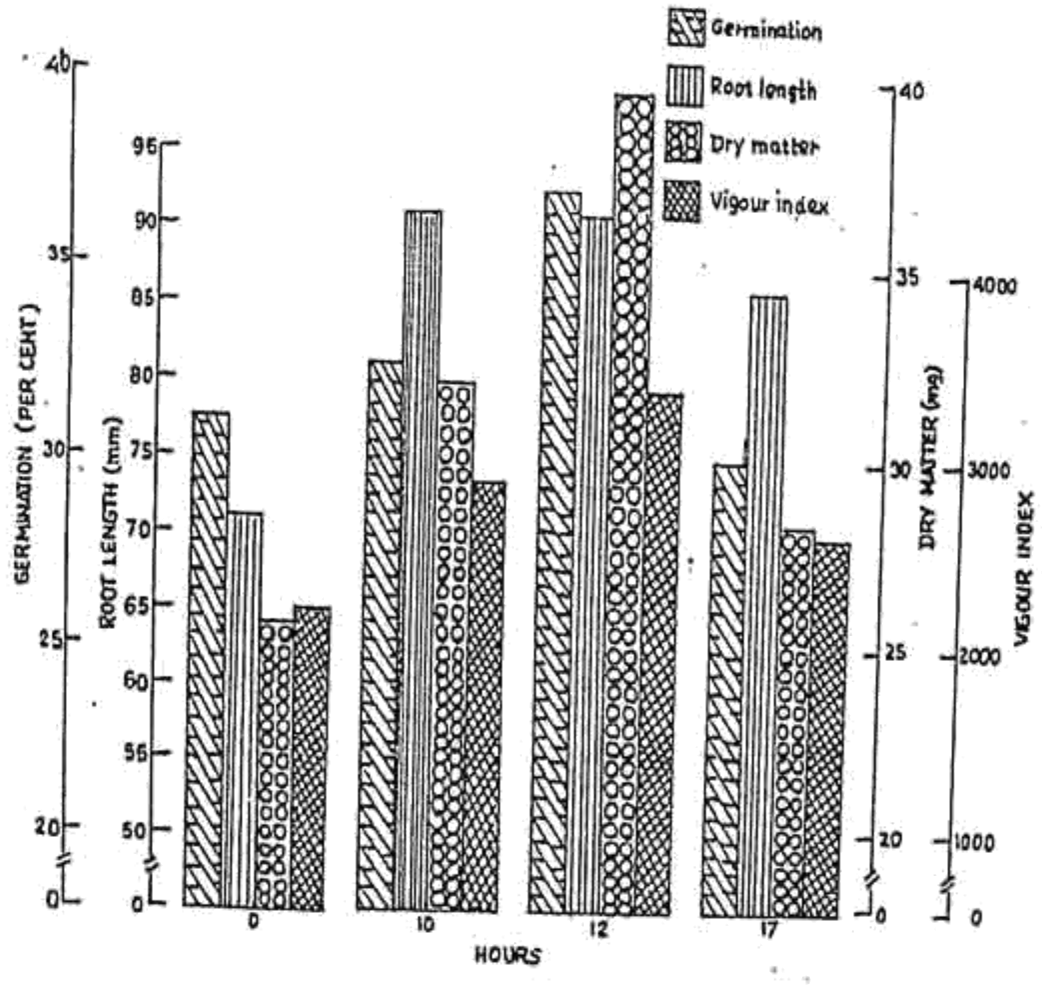

Fig.4 Effect of Iodine permeation of Gingelly seeds cv. TMV 3 on viability and vigour

germination and vigour in acceleratedly aged seeds.

The results of ME-D treatment showed significant differences in the germination and vigour between periods of moisture equilibration (Table 3; Fig. 3). The seeds equilibrated for 24 h followed by drying back recorded the highest germination (58%) as compared to other durations. The control seeds as well as those equilibrated for periods below and above 24 h showed lower values. The root and shoot length, dry matter content and the computed vigour all showed significant differences among periods of moisture equilibration. The mean values recorded for 24 h ME-D were significantly high in respect of root length (87.8 mm), shoot length (63.3 mm), dry matter production (30 mg) and vigour index (5089) as compared to control and other durations of moisture equilibration.

The gain in seed moisture was rather slow and steady. The total moisture gain was only 14.3 per cent at 96 h and it was only 10.2 per cent at 24 h. The ultimate increase in seed moisture content however, was only 5.8 per cent which resulted in the effective control of deterioration process in seeds.

The results of IP-D revealed significant differences in the germination percentage of acceleratedly aged seeds subjected to different durations (Table 4; Fig. 4). The seeds permeated for 12 h recorded the highest germination of 37 per cent as compared to those from other durations as well as the control. The seedling vigour assessed by the root length, dry matter content and the vigour index all showed significantly high values with 12 h IP-D namely, 91.7 mm, 39 mg and 3387, respectively as compared to rest of the treatment durations.

The bulk quantity of seeds stored in cloth bag at 4-5 per cent moisture suffered a significant loss in germination and much more in respect to vigour within four month of storage. This loss in viability and vigour of seeds on subsequent storage indeed, was much noticeable. The results revealed that fourth month after the harvest of the seed may be the optimum time for the mid-storage treatment commensurating with deterioration. Age of the seed determined the effectiveness of hydration-dehydration treatment. It was ineffective or even damaging to fresh seeds and on the other hand very old seeds did not give the desired effe[illegible] (Bas[illegible] [illegible] 979)

The results of each one of the pre-treatment methods amply confiemed thebeneficial effects on the maintenance of viability and vigour, when 2 h H-DH, 24 h ME-D and 12 h IP-D were adopted. Treatments over short or long duration did not confer the full benefits as revealed by their reduced germination and vigour potential of the acceleratedly aged seeds. Significance of optimum duration of treatment to realise the full benefits were documented in the studies of Basu *et al.* (1978); Dharmalingam and Basu (1978); and Basu and Rudrapal (1980).

It becamr evident from the study that the beneficial effects of treatments were dependant on the degree of seed hydration. The seed moidture showed a steep increase in water soaking and a steady increase in moisture equilibration treatment. These two hydration methods obviously differed in their rate as well as the total seed moisture content. The rapid influx of water soon after soaking would normally lead to soaking injury. However, this was considerably avoided in moisture equilibration treatment in which a very slow hydration coulbe be achieved without causing any injury to the cellular ultrastructure (Basu, 1976 and Parish and Leopold, 1977). The beneficial effects due to Iodine permeation treatment however, is not based on hydration effect as there was no change in the moisture content of seeds. The mode of action of iodine in viability maintenance should perhaps be viewed in terms of its effect on ploy-unsaturated fatty acid components of lipo-protein membranes (Basu and Rudrapal, 1980). The loss of membrane function might be one of the basic reasons of senescence; the tratments which would stabilise the lipoprotein membranes would extend the longivity. The reaction of iodine would stabilize the olefinic bonds and render them less susceptible to peroxidative and free radical chain propagation reactions (Basu and Rudrapal 1980). A more plausible explanation of the beneficial effects of hydration- dehydration treatments, could be based on the concept of free- radical pathology as a vital factor in seed deterioration (Basu, 1976). The basis of free-radical pathology is the presence of unpaired electrons on the radicals. Perhaps, in hydrated seeds, the free radicals become mobile enough to recombine into harmless non- radical products (Ehrenberg, 1961) and thereby, further deterioration of seeds could be controlled.

REFERENCES

ABDUL-BAKI,A.A. and J.D.ANERSON. 1973. Vigour determination in soybean seed by multiple criteria. Crop Sci. 13: 630-633.

ANONYMOUS,1976. International Rules for Seed Testing. Seed Sci. & Technol. 4: 3-49.

BASU,R.N. 1976. Physico-chemical control of seed deterioration. Seed Res. 4: 15-23.

BASU,R.N., K.CHATTOPADHYAY, P.K.BANDOPASHYAR and S.L.BASAK. 1978. Maintenance of vigour and viability of stored jute seeds. Seed Res. 6: 1-13.

BASU,R.N. and P.PAL 1979. Physico-chemical control of seed deterioration in rice. Indian J. Agric. Sci. 49: 1-6.

BASU,R.N. and A.B.RUDRAPAL. 1980. Iodination of must- ard seed for the maintenance of vigour and viability. Ind. J. Expt. Biol. 18: 492-494.

DHARMALINGAM,C. and R.N.BASU. 1978. Control of seed deterioration in cotton (Gossypium hirsutum L.) Curr. Sci. 47: 484-487.

EHRENBERG,A. 1961. Research on free radicals in enzyme chemistry and in radiation biology. In Free radicals in Biological systems (ed. M.S. Blois; H.W.Brown; R.M.Lemmon, R.O.Lindblom and M.Weissbluth) 337-350. Academic Press Inc. New York.

PARRISH,D.J. and A.C.LEOPLOD. 1977. Transient changes during soybean imbibition. Pl. Physiol. 59: 111-115.

WOODSTOCK,L.W. and J.FEELEY, 1965. Earlyseedling growth and initial respiration rates as potential indicators of seed vigour in corn. Proc. Ass. Off. Seed Annlysis 55: 131-139.

Madras Agric, J., 40-46 January 1993

HETEROSIS IN WATERMELON (Citrullus lanatus Thunb. Mansf.)

P.C.RAJENDRAN* and S.THAMBURAJ

MATERIALS AND METHODS

Six inbred parental genotypes viz., Pudur-2 (P_1), Honey Island Yellow Flesh (P_2), Asahi Yamato (P_3), Sugar Baby (P_4), Maruthamalai-I (P_5) and H.W.I (P_6) representing a wide geographic diversity selected for this study were obtained from various sources and were used for the experiment. After selfing fox six generations, the six parental varieties were crossed in all possible combinations (n^2-n) in diallel fashion during winter 1987- '88 (December-March). A total of thirty hybrids (direct and reciprocals) along with their parents were raised in a randomized block design replicated twice during summer (March-June) 1988. A spacing of 2.50 m between two rows of furrows and the intra row spacing of 0.90 m were adopted. Five plants excluding the border ones in each cross combination and in each replication, out of fifteen plants were selected at random and tagged for recording observations. Standard horticultural practices and plant protection measures were followed in the experimental field as suggested by the Faculty of Horticulture (Anon, 1985). Observations were recorded on 10 economically important characters in all the hybrids and their parents. The mean values of the recorded data were used for computing heterosis. The magnitude of positive heterosis for traits such as number of fruits per vine, average fruit weight and yeild per vine, T.S.S. and ascorbic acid was calculated by using highest values. While in the case of characters like vine length, crop duration, days taken for the first female flower to appear and node number of first female flower, negative heterosis was calculated by utilizing the minimum values.