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EFFECT OF SEED PRETREATMENTS ON THE GERMINATION OF SEEDS OF SOME VARIETIES OF SOYBEANS

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ABSTRACT

The effects of two seed pretreatments on the germination of seeds of eight varieties of soybean *Glycine max* L. were investigated. This is with the aim of improving germination and to determine the effects of these pretreatments on the rate of and total germination of the eight varieties used. Immersing seeds in 100° hot water for 20 and 40 seconds and soaking seeds for 5 and 10 minutes produced a total percentage germination of 70-100 within 4 days of sowing. The untreated but viable seeds of three of the eight varieties gave a total percentage germination of 70 within 8 days of sowing. The three varieties that generally responded to all the treatments by giving 100 per cent total germination include Sam Soy-2, TGX-563-02D and TGX 849-313D.

KEY WORDS: Soybean, Varieties, Pre-treatments, Seeds, Germination.

Soybean, *Glycine max* L. was introduced into Nigeria nearly 70 years ago and the production attained commercial recognition during the late forties. It can produce the highest yield of protein per weight than any other plant or animal food source while at the same time producing calories (IITA, 1990). With the continuing increases in the cost of living, soybeans have become more important as a source of protein. Soybeans have however long been used in Asia and are heavily consumed in affluent developed countries. Soybean is also valuable for the oil which is used in numerous food stuff and in commercial products such as detergents, fertilizers; glue, lecithin, papers, plastics, soaps, paints and varnishes (Anon., 1950). In Nigeria, planting times vary according to the different ecological zones. These include, humid forest, 10-20 July; forest savanna, 20-30 June; moist savanna, 15-25 June, and the dry savanna, 5-15 June. So many varieties of soybeans are known in Nigeria. Some of these include TGX 293-63E, TGX 995-22E, TGX 536-02D, TGX 943-1E, TGX 1072-2E, TGX 849-313D, SAM SOY-2, TGX 1025-8E, TGX 536-02D, TGX 996-2E, TGX 1063-2E and TGX - 940.

Various germination responses have been observed among the varieties of soybeans introduced to the local farmers. These are often noticed in the varying rate of and total percentage germination. So many seeds, from some varieties introduced failed to germinate when planted. It appears that the germination problems confronting the eeds have not been totall overcome in some varieties of soybean introduced to our local farmers. These include presence of immature embryo, hard seed coat (Longman and Jenik, 1974),after ripening condition, germination inhibitor level etc. (Mayer and Poljakoff Mayber, 1963; Kozlowski, 1971). Seeds of some soybean varieties have hard and tough seed coats that may retard or prevent imbibition of water and exchange of gas thus slowing down initiation of germination processes.

This investigation was therefore aimed at subjecting the seeds of eight of the different varieties of soybeans commonly used for planting in Nigeria to some treatments. This will hopefully remove dormancy imposed by hard testa and thus hasten germination to have successful planting.

MATERIALS AND METHODS

Seeds of eight varieties of soybeans that are promising in commercial planting were collected from I.A.R.T. (Institute for Agricultural Research and Training) Ibadan, Nigeria. Initial germination tests were carried out using randomly selected untreated seeds from the following varieties TGX 1072-2E, TGX 1063-2E, SAM-SOY-2.TGX 996-2E, TGX 563-02D, TGX 293-63E, TGX 1025-5E and TGX 849-313D. The seeds were surface sterilised with 0.1% mercuric chloride solution for 30 seconds and rinsed in several changes of sterile distilled water. Fifty seeds were plated in each of 9 cm petri dishes lined with sterile filter papers and moistened with 20ml sterile

distilled water. Five replicates were placed in germination cabinets running at a constant temperature of 30 ± 1^{oc} and an alternating day/night regime of 30/20^{oc}. All had 12 h of light per day and seeds were watered when necessary.

Seeds were also divided into lots and subjected to the following treatments: hot water immersion for 10, 20, 40, 60 and 120 seconds at 60, 80 and 100^{oc} and concentrated sulphuric acid soaking for 5, 10, 15 minutes. This totalled 18 treatments excluding the control. The outcome of the initial germination test is used also as that of the control (untreated seeds). Acid-treated seeds were plated for germination as earlier described. A completely randomised design was used. The treatments and replications (five) were arranged in germination cabinets. The number of seeds germinated was recorded at daily intervals. Radicle emergence of up to 1.5mm was taken as visible sign of successful germination in this and subsequent experiment. The ungerminated seeds were cut into two halves through the embryo and soaked in 5% triphenyl tetra zolium chloride solution. This is with a view to verify the viability of the ungerminated seeds. Data were statistically analysed using the analysis of variance (ANOVA), least significance difference test (LSDt) at 95% probability level and Duncan multiple range test (DMRT).

RESULTS AND DISCUSSION

The results of the effect of acid treatment on the germination of seeds of the eight varieties of soybeans used are as shown in figures 1 and 2. The total percentage germination recorded among the soaking periods ranged between 40-100 in all the varieties. However, the rate ofgermination differ significantly among varieties apart from among the treatment. Soaking seeds in concentrated sulphuric acid for 10 minutes seems to be the most effective treatment in bringing about the most rapid rate of germination in all the eight varieties (Fig. 1,2) excepting TGX 536-02D (Fig.2) where soaking in acid for 5 minutes seems to be the most effective in bringing about the most rapid rate of germination. For example, 60-70 per cent germination was attained within 3 days of planting. Total germination was achieved within 4- 5 days in seeds treated in acid for 10 min as in TGX 1072-2E, SAM- SOY-2, TGX 996-2E (Fig.1), TGX 293-63E, TGE 849-313D (Fig.2). Soaking seeds in acid for 15 min gave the lowest total percentage germination among treatments. The results also showed that this same treatment gave the lowest rate of germination. For example,60- 70 per cent germination was attained on the 8th day of germination in all varieties. This could be compared to 100 per cent obtained within 4 days in seeds soaked in acid for 10 min. All the three acid-treatment periods favour germination in three out of the eight varieties used. These include Sam Soy-2 (Fig.1c), TGX 536-02D (Fig. 2c) and TGX 849-313D (Fig. 2d).

The germination response of the seeds of the eight soybean varieties investigated using three hot

Table 1. The effect of heat treatment at 60^{oc} (hot water) on total percentage germination of varieties of soybeans

Time of Exposure (Seconds)	Varieties							
	TGX 1072-2E	TGX 1063-2E	SAM Soy-2	TGX 996-2E	TGX 563-02D	TGX 293-63E	TGX 1025-5E	TGX 849-313D
Control	30 ± 1.2c	40 ± 3.7c	10 ± 0.2b	40 ± 4.2b	40 ± 2.5a	50 ± 1.2c	40 ± 1.2c	35 ± 2.6c
10	35 ± 0.6c	40 ± 1.7c	10 ± 0.7b	40 ± 3.3b	45 ± 3.4a	55 ± 0.6c	45 ± 0.6c	40 ± 1.2c
20	40 ± 1.4c	55 ± 3.3b	25 ± 1.2b	45 ± 2.7b	50 ± 1.6c	60 ± 1.7c	50 ± 2.3c	55 ± 0.6b
40	65 ± 2.6b	60 ± 4.1b	55 ± 3.4c	50 ± 3.4b	60 ± 4.4c	85 ± 4.2a	75 ± 5.7a	65 ± 1.3b
60	70 ± 2.1b	65 ± 2.4b	60 ± 1.7c	70 ± 1.2a	75 ± 2.7b	90 ± 3.3a	95 ± 1.6b	85 ± 4.5a
120	100a	100a	100a	90 ± 3.4c	80 ± 3.1b	75 ± 1.8b	85 ± 3.4b	60 ± 1.7b

Data are means of five replicates. The same letter within a column indicate no significant difference between means at P = 0.05 (DMRT)

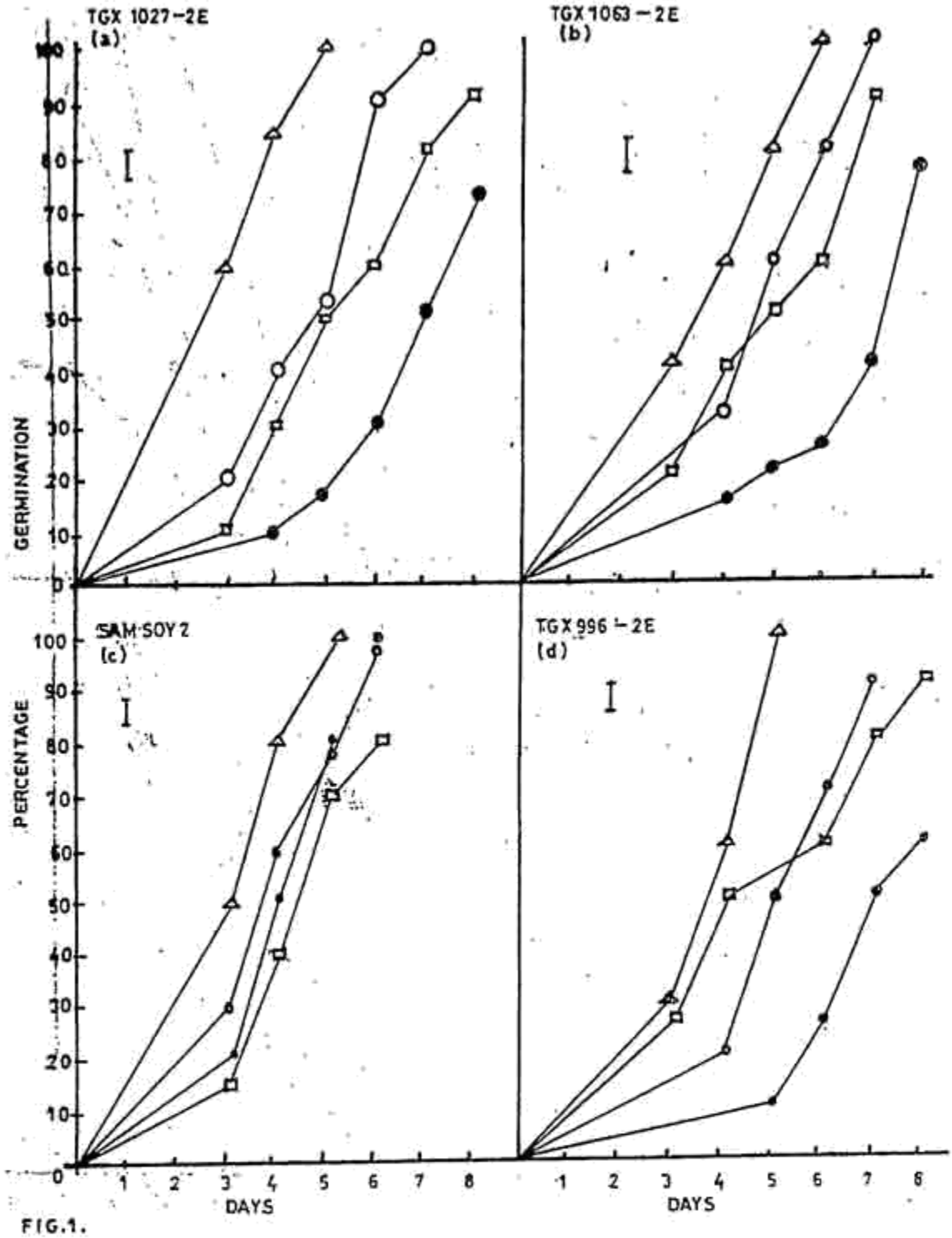

FIG.1.

Fig.1. Percentage germination of seeds of varieties of soybean after scarification with concentrated sulphuric acid for 5 minutes o----o, 10 minutes Δ---- Δ, and 15 minutes ●------●. □-------□ = control (untreated). Each point is the mean of 5 replicates. LSDt at P = 0.05 are indicated.

water treatments for five different periods are as shown in tables 1-3. Seeds of five varieties showed total percentage germination of 100-80 where they were treated in 60°C hot water for 120 seconds. These include TGX 1072-2E, TGX 1063-2E, SAM-SOY-2, TGX 996-2E (Table 1). The other remaining three *i.e* TGX 293-63, TGX 1025-5E and 849-313D showed a total germination of 85-90 per cent when their seeds were treated in same temperature.

The result on the effect of hot water at 80°C on the total germination of seeds showed a varying response by the varieties. The varieties whose seeds gave total germination are Sam-Soy-2 (at 80°C for 120 seconds) TGX 849-313D (at 80°C for 40 seconds Table 2). However, TGX 1063-2E and

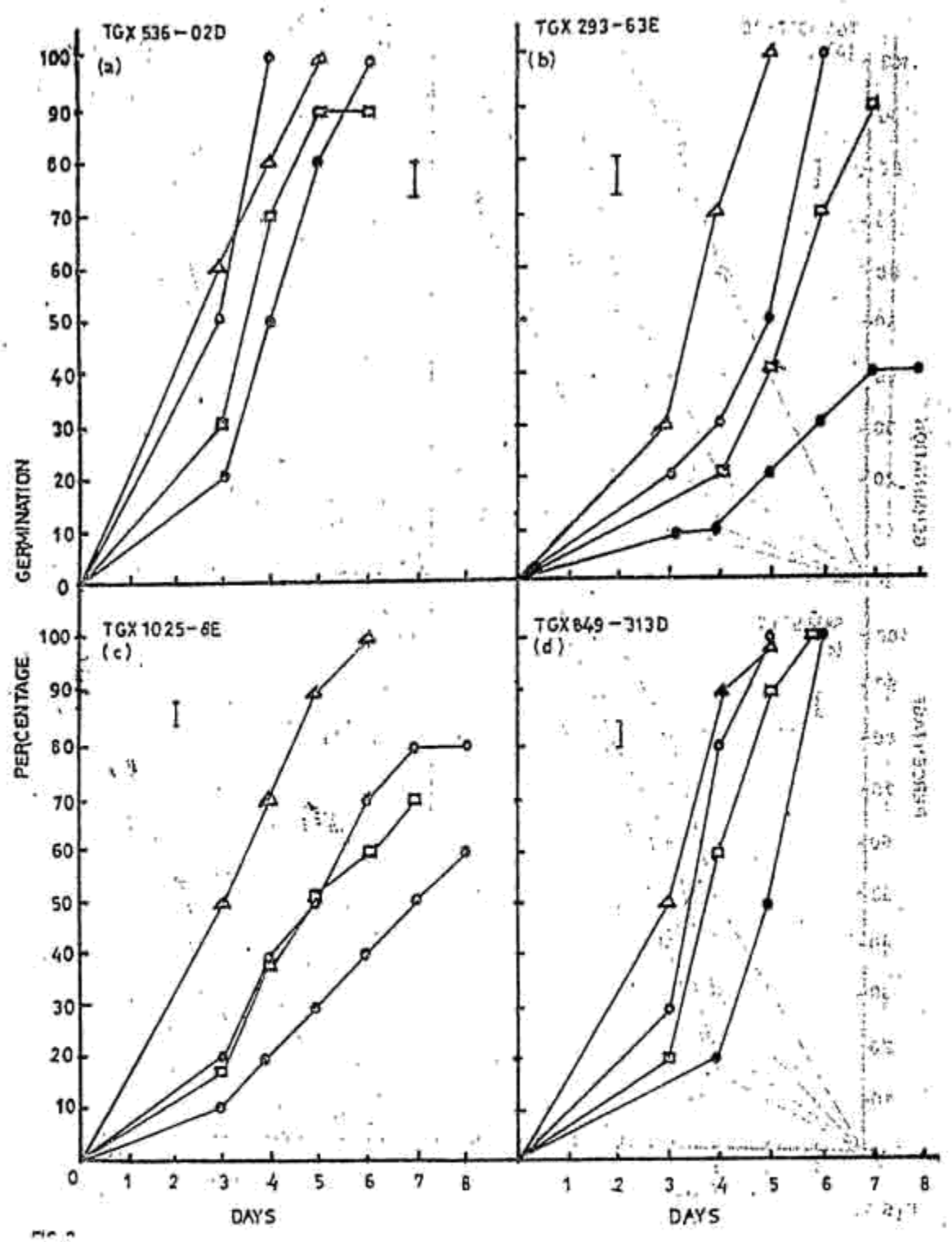

Fig.2. Percentage germination of seeds of varieties of soybean after scarification with concentrated sulphuric acid for 5 minutes o---- o, 10 minutes Δ------Δ, and 15 minutes ●-------● .□-----□ = controal (untreated)..... Each point is the mean of 5 replicates: LSDt at P = 0.05 are indicated.

TGX 293-63E showed 85 per cent germination when treated in 80°c hot water for 20 and 40°c seconds respectively. The total germination under the different period in 100°c hot water treatment also differ significantly (p = 0.05) (Table 3). The highest value of 100 per cent germination was first observed in TGX 1025-5E and TGX 1063-2E treated for 10 seconds. This was followed by TGX 1072-2E and SAM-SOY-2 treated for 20 seconds, TGX 996-2E and TGX 563-02D 40 seconds and TGX 996 - 2 E treated for 120 seconds (Table 3). Seeds treated in 100°c hot water for 40 seconds showed a comparatively higher total percentage germination among treatments. Treatment means were compared using LSD multiple range test. Immersing seeds in 100°c hot water for 20 and 40

Table 2. The effect of heat treatment at 80^{oc} (hot water) on total percentage germination of varieties of soybeans

Time of Exposure (Seconds)	Varieties							
	TGX 1072-2E	TGX 1063-2E	SAM Soy-2	TGX 996-2E	TGX 563-02D	TGX 293-63E	TGX 1025-5E	TGX 849-313D
Control	30 ± 1.2	45 ± 3.1	40 ± 4.0	10 ± 1.1	25 ± 2.4	45 ± 1.6	25 ± 4.1	40 ± 3.4
10	30 ± 2.4a	50 ± 2.4a	40 ± 1.6a	10 ± 0.3a	30 ± 4.2a	55 ± 3.1a	30 ± 3.1b	45 ± 2.4a
20	40 ± 4.3a	85 ± 1.6b	50 ± 3.4a	10 ± 1.1a	40 ± 6.1a	60 ± 4.2a	40 ± 4.2b	65 ± 2.1a
40	55 ± 2.6b	60 ± 3.4b	60 ± 1.7a	30 ± 3.4a	50 ± 1.7b	85 ± 6.1c	40 ± 2.7b	100c
60	65 ± 6.4b	40 ± 0.9a	100c	40 ± 2.3a	60 ± 4.6b	60 ± 1.7a	85 ± 1.6c	70 ± 3.1c
120	45 ± 4.3b	30 ± 1.7a	60 ± 4.2a	60 ± 6.4a	100c	45 ± 3.4b	90 ± 0.9c	40 ± 1.7a

Data are means of five replicates. The same letter within a column indicate no significant difference between means at P = 0.05 (DMRT)

seconds and soaking seeds in concentrated sulphuric acid for 5 and 10 minutes were the most effective in preducing 70-100 per cent total germination within 4 days of sowing. The untreated seeds of some varieties gave a total percentage germination as high as 70-100 per cent attainable as from the 8th, day as compared to the same value attainable under days in the treated seeds (Fig.1,2).

Some of the pretreatments used for the seeds of the eight varieties of soybeans gave highest total percentage germination and rapid rate of germination. Immersing seeds in hot water may have enhanced germination by providing a stimulatory effect on the germination process and by causing the tough testa to rupture. This therefore creates a passage through which water entered into the seed (Cavanagh, 1987; Marunda, 1989). Sulphuric acid rendered the seed coats soft causing uniform inflow of water and unrestricted expansion of the embryonic parts. The difference in the germinability response of the soybean seed varieties shows the variability in the seed coat structure. This is why those with less tough testa needed only a little period of soaking in acid and exposure to less high temperature treatment. On the contrary, very hard seeded ones needed higher period of soaking in acid or very hot water

Table 3. The effect of heat treatment at 100^{oc} (boiling water) on total percentage germination of varieties of soybeans

Time of Exposure (Seconds)	Varieties							
	TGX 1072-2E	TGX 1063-2E	SAM Soy-2	TGX 996-2E	TGX 563-02D	TGX 293-63E	TGX 1025-5E	TGX 849-313D
Control	65 ± 3.4a	96 ± 3.1b	50 ± 1.2a	40 ± 1.6a	35 ± 1.6a	30 ± 2.4a	95 ± 2.4a	40 ± 2.6a
10	75 ± 2.1a	100b	55 ± 2.5a	40 ± 1.2a	40 ± 1.7a	30 ± 1.7a	100a	40 ± 1.3a
20	100b	70 ± 4.1a	100b	55 ± 0.7a	65 ± 2.5b	45 ± 2.3a	60 ± 1.7b	55 ± 1.4a
40	80 ± 3.4a	65 ± 2.4a	60 ± 2.2a	100c	100c	70 ± 1.4c	55 ± 2.6b	60 ± 1.7
60	70 ± 4.2a	40 ± 1.2c	45 ± 1.7a	40 ± 0.8a	70 ± 6.4c	60 ± 4.1c	20 ± 3.4c	100b
120	55 ± 5.1c	30 ± 6.1c	35 ± 4.0a	30 ± 3.4a	45 ± 2.5a	100b	10 ± 0.2c	30 ± 0.7a

Data are means of five replicates. The same letter within a column indicate no significant difference between means at P = 0.05 (DMRT)

treatment (80-100°c). Seeds of varieties TGX 563-02D and TGX 293-63E are included in this category.

The degree of dormancy in seeds has been associated with many reasons including hard seededness (Hyde, 1954; Esau, 1965). Studies by Kozlowski (1971) have increasingly pointed out that the barrier effect of the seed 'coats' could be due to the physical or chemical characteristics of the seed coats as well as the permeability changes to water, gases or solutes (Khan, 1980). The scarcity of water available to the embryo due to impervious seed coats is no doubt an important aspect of dormancy (Agbool and Etejere, 1991). Some varieties given to farmers show poor performance in terms of germinability. This is despite the fact that they germinated in the laboratory though in a slow rate. This is likely due to the fact that some seeds might have lost their vigour and viability during storage. Some seed may also not have completed their overripening period after previous harvest (Akinola, 1980).

In the absence of all these factors the bad planting practices especially where seeds are buried too deep into the soil may be a contributing factor for their poor germiniability on the farm. However the use of viable seeds from recommended varieties such as those of Sam Soy-2, TGX 563-02D and TGX 849-313D is advised. More research work on the storability of the soybean seed is also advised.

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HIGH YIELDING FODDER GRASS SUITABLE FOR NORTH WESTERN ZONE OF TAMILNADU

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ABSTRACT

Production potential of nine perennial fodder grass entries was evaluated at the Tamil Nadu Agricultural University, Regional Research Station, Paiyur during 1984-87. The cumbu napier hybrid grass Co 1, produced higher green fodder yield (250 t ha^{-1} $year^{-1}$), exhibited a greater leaf to stem ratio (0.86) and high protein yield (8.41 t ha^{1}) under irrigated condition.

KEY WORDS : Fodder grass, Yield, Protein, Economics

Maintenance of dairy cattle is an important north western zone of Tamil Nadu. Presently,