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Full Length Research Paper

Relationship between Laboratory Seed Quality Test and Field Performance on Cowpea (Vigna unguiculata [L]. Walp)

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A study was carried out to investigate the relationships among leaching of electrolytes from seeds into steep water, germination and field emergence and performance on cowpea (*Vigna unguiculata* (L.) Walp.) genotypes. The experiment was conducted at the Institute of Agriculture, Moor Plantation, Ibadan using six (6) genotypes of cowpea. All laboratory tests were conducted using complete randomized design (CRD), replicated three (3) times with 50 seeds per replication, experimental design used on the field was Randomized Complete Block Design (RCBD).

The results showed that significant differences existed ($p<0.05$) among the genotypes examined. With respects to germination percentage it ranged from 3.67% to 70.67%. Ife Brown had the highest germination percentage of 70.67 among the genotypes. it also appeared to have good seed quality and high seed yield of 566.

10kg. Coefficients of correlation between field emergence, seed yield and seed testing traits differed for all varieties; seed germination and seed vigor were positively correlated with field emergence. Result shows that seed conductivity test was negatively correlated with seed yield/ha. It was observed that poor seed quality, have greater effects on performance of plant on the field. Therefore, the results suggested that poor quality seeds will affect the field emergence which may affects the yield and agronomic performance of the crops.

Keyword: Relationship, Quality test, Cowpea, Field Performance, Laboratory Seed

INTRODUCTION

Quality seeds of improved varieties are the key to agricultural progress. The production potential and other desirable characteristics of seeds set the limits on production. Other inputs such as fertilizers, pesticides, herbicides and overall crop management also help to realize the production potential of seeds. Part of the success of a farmer's crop depends on the quality of seed (Srivastava, 1986). Seed testing is often the first step in enhancing the quality of the seed. The testing can be minimal only for germination, or very extensive for moisture, purity, germination, health and other characteristics (Gastel, 1986). Some tests such as tetrazolium, seedling growth rate and seedling dry weight, accelerated aging test, first count, speed of germination, cool germination test and cold test are used to estimate seed vigor (Roberts, 1993). Many researchers have reported significant correlation coefficients between field emergence and standard laboratory germination tests, but they have also reported inconsistencies and difficulties with the prediction of field emergence. Standard laboratory germination tests describe the percentage of normal seedlings under optimal conditions specified by the International Seed Testing Association (ISTA, 1993). This test, commonly used to evaluate seed quality, is able to predict field emergence provided the conditions for emergence are favorable. Many authors found laboratory germination tests to correlate well with field emergence of soybean (TeKrony and Egli, 1977; Johnson and Wax, 1978; Yaklich and Kulik, 1979,) and field bean (*Vicia faba* L.) (Hegarty,1977). The effect of

Table 1: Mean value of warm germination parameters of Cowpea

Variety	G %	EI	ERI
Ife Bimpe	43.67_c	5.60_a	12.45_a
IT 90k-227-2	37.33_b	5.32_a	14.97_b
Modupe	11.33_b	5.44_a	14.97_b
Ife 98-12	41.33_b	5.03_a	13.00_b
Erusu	40.67_b	5.09_a	13.07_b
Ife Brown	70.67_a	4.69_a	7.07_b

Means with the same letters(s) along the same columns are not significantly different ($p<0.05$).
$G^0/_0$: germination percentage, EI: Emergence Index(days), ERI(days): Emergence rate index.

seed vigor on yield depends on the form of crop harvested, crops harvested during vegetative or early reproductive growth demonstrate a consistently positive relationship between seed vigor and yield (Tekrony and Egli, 1991), total emergence was correlated significantly with standard germination, whereas both total emergence and forage yield were correlated significantly with accelerated aging percentage (Hall and Wiesner, 1990). The slower the rate of emergence frequently associated with low – vigor seed contributes to the development of smaller plants and reduced vegetative yield relative to the use of high – vigor seed (Ellis, 1989). Therefore, the objectives of this study were to determine the relationship between laboratory seed quality test and field emergence of cowpea and to determine the effect of quality seeds on cowpea seed yield.

MATERIAL AND METHOD

Six varieties of cowpea collected from Obafemi Awolowo University, Institute of Agriculture Research and Training (I.A.R & T), Moor Plantation, Ibadan from 2009 harvest were used for this study. Seed samples from the 6 cowpea varieties were assessed for seed quality using warm germination and conductivity test and evaluated in the field in 2010 cropping season at Seed Testing Laboratory and Research Farm of the institute. After cleaning, the seeds were divided into two lots. One of the lots was used for the laboratory seed quality tests and the other the field experiment.
Seed samples of different varieties for each population were investigated in the laboratory for the following:

CONDUCTIIVITY TEST

Cowpea seeds were steeped in distilled water for 24 hours in 250 ml flask containing 100 ml of sterile distilled water at room temperature. Electrolyte leakage was determined using 3 replicates of 50 weighed dry deeds with JENWAY 4510 digital electrical conductivity meter arranged in a completely randomized design (CRD). The flasks were covered with aluminum foil to prevent contamination and were gently shaken at 5 hours interval. The exudation of electrolytes from each sample was measured after 24 hours of soaking with the JENWAY 4510 digital electrical conductivity meter expressed in µS/cm/g.

STANDARD GERMINATION

Sterilized river bed sand was used for standard germination. The sand was sieved with 2mm sieve to ensure uniform particle size. Seed germination was measured by placing 50 seeds per replication in sand inside plastic bucket and were kept at warm temperature of about 25^0c for 7 days, after which germination percentage was determine according to the Association of Official Seeds Analyst (AOSA) guide-line (AOSA, 1983).

FIELD TRIAL

The field trial was conducted in September 2010 to evaluate the effect of variety on field performance. The experimental area measured 7.4m x 18m while the plot size was 1.8m x 3m having 1m between plots and within the blocks. With 60cm x 30cm spacing to give a total population of 111,111.11 seedlings per hectare. Two (2) seeds were sown per hole. Ploughing and harrowing were done before laying out the experimental field. Weeds were manually controlled by hoeing. Spraying commenced 3 weeks after planting until anthesis, with Laraforce (a.i. Lambda Cyhalothrin 2.5% EC). The number of seedlings ($^0/_0$) that emerged from day 3 after planting to day 7 were counted. Other agronomy parameters measured include, plant stand per plot, plant height, days to flower, 50% flowering. Data collected from the two experiments were subjected to analysis of variance using general linear model and significant means were separated using Duncan's multiple range test (DMRT) at 5% probability level

RESULT AND DISCUSSION

Table1 showed the mean value of germination parameters of cowpea variety. The result showed that Ife Brown had the highest germination percentage of 70.67 compared to Ife Bimpe which has the lowest germination percentage (43.67). There were significant different ($p<0.05$) among the varieties with respect to germination percentage. It ranged from 43.67% to 70.69%. With respect to emergence index there was no significant difference among the varieties. Emergence rate index indicate the days that will take 100 seeds of varieties to germinate completely. From the results, it will take 100 seeds of Ife Brown 7.07 days to germinate, which indicate that Ife Brown is of high quality. This is in agreement with result reported by Egli and TeKrony (1995) which showed that the relationship between laboratory test and field emergence is complex and the ability of laboratory tests to predict field emergence is variable and strongly dependent on the field environment.

Table 2: Mean value of conductivity after 24hrs

Variety	WI	BµS
Ife Bimpe	5.62c	219.89a
IT 90k-227-2	8.05a	154.89a
Modupe	6.24c	166.58b
Ife 98-12	8.58a	166.85b
Erusu	7.14b	70.89c
Ife Brown	8.58a	61.13c

Means with the same letters(s) along the same columns are not significantly different (p<0.05).
WI: Water imbibed, µS: conductivity reading in µs/cm/g.

Table 3: Mean value of some agronomic parameters of cowpea cultivars

Variety	PS	PH	DTF	50%F
Ife Bimpe	9.67c	49.50a	44.67a	52.67a
IT 90k-227-2	24.00ab	46.92ab	41.67a	51.33a
Modupe	20.00bc	44.08ab	44.33a	51.67a
Ife 98-12	27.67ab	41.50b	39.67a	51.33a
Erusu	31.33ab	45.83ab	40.33a	49.00a
Ife Brown	36.00a	42.67b	43.00a	52.67a

Means with the same letters(s) along the same columns are not significantly different (p<0.05).
PS: plants stands per plot, PH: plan height, DTF: days to flower, $50^{\%}$F: flowering.

Table 4: Mean value of some agronomic parameters of cowpea cultivars

Variety	HTP	NSP/P	PWT/P	SWT/P	SYLD/ha
Ife Bimpe	9.67c	7.66a	76.67a	43.33a	299.90ab
IT 90k-227-2	32.00ab	9.83a	143.33a	66.67a	336.90ab
Modupe	20.00bc	6.75a	106.67a	53.33a	350.60ab
Ife 98-12	27.67ab	7.92a	96.67a	46.67a	378.10ab
Erusu	31.33ab	7.42a	140.00a	83.33a	378.10ab
Ife Brown	36.00a	7.67a	150.00a	86.67a	566.10a

Means with the same letters(s) along the same columns are not significantly different (p<0.05).
HTP: harvested plant, NSP: no of seed per pod, PWT/plot: pod weight, SWT/plot seed weight/plot, SYLD/ha: seed yield/ha.

Table 5: Correlation between laboratory seed quality test and field emergence

	Germination percentage
Warm germination percentage	0.7402**
Germination Index	0.1550
Germination Rate Index	-0.05969**
Bulk conductivity test	-0.06895**

Mean values of conductivity test were presented in Table 2. From this Table, Ife Bimpe had the highest conductivity value of 219.8 µS/cm/g which was significantly deferent from other cultivars at p<0.05. These high conductivity values denote poor quality seeds (ISTA, 1993). The poor establishment and yield performance of plants grown from low viability seed lots are attributable to physiological, biochemical, and cytogenetically imbalances in the seed (Dharmalingam and Basu, 1989). There are no significant difference in the days to flower and 50% flowering of the cowpea cultivars (Table 3). The table also shows that Ife Brown has the highest plant stand while Ife Bimpe has the lowest plant stand per plot. Mean value of some agronomics parameters of cowpea cultivars were presented in Table 4. It was recorded that Ife Brown has

Table 6: Correlation between Laboratory Seed quality test and yield parameters

	PW	SW/plot	SYD/ha	100WT
Bulk	-0.419*a	0.021	-0.021	-0.144
Lab g	0.426	0.414	0.200	0.192

PW: Pod weight(kg/plot), SW/plot: Seed weight(kg)/plot, SYD (kg)/ha: Seed yield/hectare, 100WT: 100 SEED weight.

the highest harvested plant stand (36.00) and there is no significant deference in terms of number of seeds per pod and pod weight per plot among the cultivar. Ife Brown had the highest seed yield value of 56.10g/ per plot. The germination ability and vigor of a seed lot is related indirectly to performance in the field in which low seed vigor contributed to reduced forage or grain yield (TeKrony and Egli., 1991).

Correlation between laboratory seed quality test and field emergence were presented in Table 5. From the result laboratory germination was positively correlated with field emergence. Standard laboratory germination tests describe the percentage of normal seedlings under optimal conditions specified by International Seed Testing Association (ISTA, 1993). This test, commonly used to evaluate seed quality, is able to predict field emergence provided the conditions for emergence are favorable. TeKrony and Egli (1988) reported that laboratory germination test is well correlated with field emergence. Correlation between laboratory seed quality test and yield parameter of cowpea cultivars were presented in Table 6. From the results laboratory seed quality test was negatively correlated with seed yield. The slower the rate of emergence frequently associated with low-vigor seed contributes to the development of smaller plants and reduced plant yield (Ellis, 1989). It was observed that poor seed quality have greater effects on performance of plant on the field. The results suggested that poor quality seeds will affect the field emergence, which may affects the yield and agronomic performance of the crops (Egli and Tekrony, 1995).

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