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Effect of hydropriming on the growth performance of Three Vegetables; *Corchorus olitorius, Celosia argentea* and *Abelmoschus esculentus*

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Abstract

Vegetables constitute an important part of human diets. They contain nutrients that are necessary for proper growth, development and health in humans. Cultivation of vegetables is therefore important. Priming is one of the methods employed to improve the germination, growth and yield of major crop plants. Two accessions each of three vegetables (*Celosia argentea, Abelmoschus esculentus* and *Corchorus olitorius*) were pre – treated with priming dehydration treatment prior to sowing. The experimental design was a Randomized Complete Design (RBD) with seven treatment levels and two replications. The treatments are; primed dried and primed not dried and unprimed which served as control (untreated seeds). Results indicated that traits such as leaf number, plant heights, and leaf area were significantly affected by priming treatment at ($p<0.05$) probability level. The priming treatment had significant effects on the vegetables as the primed dried and primed not dried seeds had greater increase in height, leaf number and as well as leaf area. *Celosia argentea* and *Corchorus olitorius* were seen to have higher vegetative growth with primed seeds. Priming treatments improved the growth conditions and hence the yield of the crops.

Keywords: development, growth, priming, nutrients, unprimed, vegetables.

Introduction

Leafy vegetables have long been known to be indispensable ingredients in traditional sauces that accompany carbohydrate staples. Vegetables supply most of the nutrients that are deficient in other food materials. This includes supply of minerals, especially calcium and iron. Vegetables are acid neutralizers (e.g. okra), *Corchorus* species neutralizes the acid produced from some fruits. Vegetables prevent constipation and promote digestion as a result of the dietary fiber they contain. The increased awareness of the health protecting properties of the bio-active compounds found in fruits and leafy vegetables has directed immense attention to vegetables as vital components of daily diets. The joint World Health Organization and Food Agricultural Organization report on a Global Strategy on Diet, Physical Activity and Health, recommended a minimum daily intake of 400g of fruits and vegetables (Francisca and Pablo, 2007).

Seed priming is a pre-sowing strategy for influencing seedling development by modulating pre-germination metabolic activity prior to emergence of the radicle and generally enhances germination rate and plant performance (Bradford, 1986; Taylor and Harman, 1990).

Seed priming has been successfully demonstrated to enhance the growth parameters in seeds of many crops particularly seeds of vegetables and small seeded grasses (Arif *et al.,* 2008). Seed priming by soaking seeds in water overnight, drying them before sowing markedly improves plant stand, establishment, vigour, and the final yield (Harris *et al*., 1999; Rashid *et al*., 2002). Seed priming improves plant height, root dry weight, shoot dry weight, root length, shoot length and chlorophyll of plants compared to plants raised from the untreated seeds. (Basu, *et al.,* 2005).

This research work was carried out to investigate the effects of hydration-dehydration (hydro-priming and re-drying) as pre-sowing treatments on the growth and performance of three vegetable species; *Corchorus olitorius, Celosia argentea and Abelmoschus esculentus.*

Materials and Methods

The experiment was carried out with two accessions each tagged 1and 2 respectively of *Celosia argentea, Corchorus olitorius and Abelmoschus esculentus*. The seeds were obtained from The National Centre for Genetic Resources and Biotechnology (NACGRAB) Moore plantation, Ibadan Oyo state Nigeria.
The practical work was carried out at University of Ilorin, Faculty of Agriculture pavilion. The experimental design was a completely randomized design. Seed planting buckets with capacity 3 liters were arranged in three rows, each of which contained the two accessions of *Celosia, Corchorus* and *Abelmoschus*.

Loamy soil was used to fill the 3 liters buckets capacity up to three- quarters (¾) of the full capacity. The loamy soil collected was sieved, mixed to ensure homogeneity of the soil. Each of the seed lots collected was divided into three parts representing unprimed seeds (control), primed dried seeds and primed not dried seeds (each of the treatment was replicated three times). This made a total of twenty seven parts. Six was taken out from each of the three species and treated, soaked for twenty four hours and dried for the next twenty four hours during which another six parts was being soaked. This is to ensure uniform planting date for the experiment. The seeds were then sown into the buckets after the treatment. The plants were watered daily.
After two weeks of planting, a 3.0g each of N-P_2O_5.K_2O_5 fertilizer was weight on an electrical digital weighing balance and were applied to each of the plant seedlings against the recommended ratio 10:4.2:8.3 of N-P_2O_5.K_2O_5 fertilizer. Each pot was thinned out leaving five seedlings each. Growth parameters such as leaf number, plant height and leaf area was taken weekly.
Leaf number: a pre-tagged plant was chosen from each treatment and their replicates and weekly count of their leaves were taken.
Plant height: the height of each tagged replicate was recorded weekly with the aid of a measuring tape. This measurement was taken from the soil level to the apex of the shoot.
Leaf area: for each replicate, a tagged plant was chosen and with the aid of a measuring tape, the length and breadth of the leaves were measured and multiplied to get the leaf area.
The results were analyzed using SPSS (Statistical Package for Social Sciences) with significant differences separated by DMRT (Duncan's Multiple Range Test).

Results

The experimental results obtained are represented below in tables as: plant height, leaf number, leaf area, stem girth, fresh weight, and dry weight.

Effect of hydro priming on vegetable stem height:

***C. argentea* 1. (NGB01239) 2. (NHGB/09/09)**

Table 1 shows the effect of hydro priming on the two cultivars of Celosia (*Celosia argentea* NGB01239 and NHGB/09/09). There were no significant differences at 2WAP between the control and primed dried, but significant differences occurred at 3, 4, 6 and 7WAP. The least stem height value (1.67cm) at 2WAP was observed in the control. Stem height of the primed seeds of *Celosia* 1 increased with increase in number of weeks as compared with the control. The primed dried seeds had the

highest increase in stem height at 2, 3, 4, 5 and 6WAP, while the primed not dried seeds had the highest stem height value (76.0cm) at 7WAP. This suggests that for *Celosia* 1, priming and re-drying prior to sowing favoured the increase in plant height. In *Celosia argentea 2* (NHGB/09/09), there were no significant differences at 2WAP and 3WAP between control with primed dried and primed dried with primed not dried seeds respectively. The seedlings from primed seeds initially expressed greater increase in stem heights within early weeks when compared with the control but later had reduced stem heights with further increase in weeks. Though the seedlings from primed seeds maintained increase in height, the seedlings from unprimed seeds later at 5, 6 and 7WAP recorded most increase in height followed by seedlings from primed not dried and then primed dried seeds. This shows that For *Celosia* 2, the plants will have increased in height when the seeds are not primed.

***A. esculentus* 1.(NGB01186) 2. (NGB01190)**

Table 2 shows that there were no significant differences in the stem height at 2WAP in the seedlings from the two cultivars of *A. esculentus* 1&2 (NGB01186 and NGB01190) between primed dried and primed not dried seeds. At 3, 4, 5, 6WAP there were no significant differences among the treatments but the differences were significant at 7WAP. The least stem height value (3.01cm) was obtained at 2WAP in primed not dried and highest value (27.67cm) at 7WAP in control. This suggests that sowing the seeds of *Abelmoschus* 1 without priming favored the increase in its height with weeks. In *A. esculentus* 2. (NGB01190) shows no significant different at 2, 3, and 4WAP between the controls and primed not dried but at 5, 6 and 7WAP there were significant differences among the treatments. At the initial stage, control seeds had the highest value at 2WAP and 3WAP, but plants from primed not dried seeds later maintained the highest increase till the end of the experiment at 7WAP as 39.33cm, while plants from the primed dried seeds had the least values at 2WAP as 5.01cm (Table3). This suggests that though without priming, the plant height may increase at first, more increase will be observed if the seeds are primed without re-drying prior to sowing.

***C. olitorius* 1. (NGB01284) 2. (NG/A0/02/11/007**)

Table 3 shows the results of the effect of hydropriming on the stem height of two cultivars of. *Corchorus olitorius* 1.(NGB01284 and NG/A0/02/11/007). At 2WAP, there were no significant differences in the stem height among the treatments, also at 3WAP between primed dried and primed not dried no significant different, but at 4, 5, 6 and 7WAP these differences were significant. The least stem height at 2WAP was recorded in the control(1.67cm). Plants from primed not dried seeds had the highest stem height values at 7WAP(44.67cm), followed by primed dried seeds, while control seeds had the least height. This suggests that priming the seeds of *Corchorus* 1 increases the plant height with increase in weeks.

In *Corchorus olitorius* 2. (NG/A0/02/11/007), table ? shows no significant different at 2WAP and likewise between primed dried and primed not dried throughout. Plants from the primed seeds of *Corchorus* 2 (NG/A0/02/11/007) had the highest stem height at the initial stage of the experiment but as the experiment progressed, the maximum height was later observed in plants from primed dried seeds. This suggests that priming and re-drying the seeds of *Corchorus* 2 favoured the increase in plant height with weeks.

Effect of hydro priming on Number of Leaves of vegetables. *C. argentea* 1.(NGB01239) 2. (NHGB/09/09)

Table 4 shows the *Celosia argentea* 1.(NGB01239) at 2WAP initially, the treatment shows no significant difference in leaves number, but with increase in weeks after planting the primed dried and primed not dried showed increase in number of leaves at 3, 4, 5, 6 and 7WAP among the treatments. The highest leaf number was observed in primed not dried seeds at 7WAP as 109.70. The primed dried seeds had the higher increase in leaf number during the first few weeks of the experiment, when compared with control and primed not dried seeds. However, at 6WAP and 7WAP primed not dried seeds had the highest leaf number. This suggests that priming the seeds of *Celosia* 1 increases the leaf number with weeks as compared with control seeds. Leaf number increased most with primed dried seeds. In *Celosia argentea* 2. (NHGB/09/09) table 3 shows that at 2WAP

in control with primed not dried shows no significant difference, while at 3, 4, 5, 6 and 7WAP, showed significant differences among the treatment. The primed dried seed had the highest mean leaf number as 125.30 followed by primed not dried seeds, but at 2WAP it recorded the least mean leaf number as 9.01, while control seed had the least values of leaf number. This shows that for *Celosia* 2 priming and re-drying the seeds favoured the increase in leaf number of the plant.

***A. esculentus* 1. (NGB01186) 2. (NGB01190)**

Table 5. Shows *Abelmoschus. esculentus* 1. (NGB01186) there was no significant differences among the treatments at 2, 3 5 and 6WAP but at 4WAP and 7WAP a significant difference was observed in number of leaves. The leaf number of NGB01186 was higher in primed seeds, particularly with the primed not dried seeds having the highest values when compared with primed dried and control seeds. This suggests that priming the seeds of *Abelmoschus* NGB01186 favoured increase in leaf number as the weeks progressed but there was higher number of leaves when the seeds were re-dried before sowing. The highest leaf number was observed in the primed seeds particularly the primed not dried seeds to be 10.33.

Leaf Number of *C. olitorius* 1.(NGB01284) 2. (NG/A0/02/11/007)

Table 6 shows the results of hydropriming of two cultivars of *Corchorus olitorius.* In NGB01284 at 2, 3, 5, 6 and 7WAP, there were significant differences among the treatments. The primed seeds had the highest recorded leaf number when compared with control. This increase occurred intermittently between the primed dried and primed not dried seeds. This shows that priming favors the increase in leaf number for *Corchorus* 1 with or without re-drying prior to sowing. In *Corchorus olitorius* 2. (NG/A0/02/11/007) there were significant differences among all the treatments. The primed dried and primed not dried seeds showed the highest values for leaf number when compared with control seeds. The primed not dried seeds showed more increase towards 7WAP. This suggests that for *Corchorus 2*, priming without re-drying prior to sowing favors the increase in leaf number with weeks.

Effect of hydro priming on Leaf Area of vegetables.

***C. argentea* 1. (NGB01239) 2. (NHGB/09/09)**

Table 7 showed the result of the effect of hydropriming on the leaf area of two cultivars of *Celosia argentea* 1. (NGB01239 and NHGB/09/09) There were significant differences in NGB01239 among the treatments at 4, 5, 6 and 7WAP. Control seeds showed the most increase in leaf area in the first few weeks when compared with primed dried and primed not dried seeds. At the mid of the experiment, the increase in values of leaf area began to occur in primed not dried seeds. This suggests that though, for control seeds, leaf area may increase at the initial stage of growth, priming without re-drying before sowing will favor more increase in leaf area. In *Celosia argentea* 2. (NHGB/09/09) the result shows that there were significant differences among all the treatments at 2, 3, 4, 5, 6 and 7WAP. The primed dried seeds maintained the highest increase in leaf area with increase in weeks throughout the experiment when compared with control and primed not dried seeds. This suggests that priming and re-drying the seeds of *Celosia* 2 (NHGB/09/09) before sowing favoured the increase in leaf area.

Effect of hydro priming on Leaf Area of vegetable.

***A. esculentus* 1. (NGB01186) 2. (NGB01190)**

Table 8 presents the results of effects of hydropriming on the leaf area of *Abelmoschus esculentus* 1. (NGB01186 and NGB01190). There were significant differences in the leaf area of NGB01186 at 2, 3, 4, 5, 6 and 7WAP among all the treatments with the control seeds having the highest value for leaf area. However, more increase was later observed with primed seeds particularly, the primed dried seeds which had the highest values to the end of the experiment. This shows that priming and re-drying prior to sowing favoured the increase in leaf area for *Abelmoschus* 1. In *Abelmoschus esculentus* 2. (NGB01190) the results also showed that there were significant differences at 2, 3, 4, 5, 6 and 7WAP among all the treatments. The primed not dried seeds maintained the highest values for leaf area throughout the weeks than, control seed while primed dried seed had the least values of leaf area. This suggests that

priming the seeds without re-drying prior to sowing, favoured more increase in leaf area.

Leaf Area of *C. olitorious* 1. (NGB01284) 2. (NG/A0/02/11/007)

Table 9 shows the effect of hydropriming on *Corchorus olitorius* 1. (NGB01284 and NG/A0/02/11/007). The result showed that there were no significant differences in NGB01284 at 2WAP between control and primed dried, while significant differences occurred at 3, 4, 5, 6 and 7WAP among all the treatments. The primed not dried seeds maintained the highest values for leaf area as 33.30cm^2 throughout the weeks followed by the primed dried seeds, while control seeds showed the least values. This suggests that priming is good in increasing leaf area, but best results will be obtained when the seeds are not re- dried after priming prior to sowing. In *Corchorus olitorius* 2. (NG/A0/02/11/007) the result showed that there was no significant difference at 2WAP and 3WAP in control with primed not dried seeds and 4WAP, 5WAP between controls with primed dried seeds among the treatments. Primed seeds showed the highest values for leaf area at 2, 3 and 6WAP, while control seeds had the highest values at 4, 5 and 7WAP. This showed that priming favoured increase in leaf area for *Corchorus* 2 NG/A0/02/11/007.

Table1. Effects of hydro priming on height (cm) of *C. argentea* 1. (NGB01239) 2(NHGB/09/09)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Celosia 1						**Celosia 2**					
Control	1.67^c	12.83^b	21.31^c	41.01^c	58.33^c	64.33^c	2.01^b	9.83^b	23.67^c	50.33^a	63.33^a	72.67^a
Primed Dried	2.71^a	16.33^a	43.61^a	63.17^a	73.02^a	74.01^b	3.02^a	11.02^a	25.67^b	39.33^c	49.67^b	59.33^b
Primed Not Dried	2.17^b	12.33^c	34.31^b	50.67^b	69.33^b	76.01^a	2.43^b	10.52^a	28.33^a	44.33^b	51.02^b	53.68^c

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 2.Effects of hydro priming on height (cm) of *A. esculentus* 1. (NGB01186) 2. (NGB01190)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Abelmoschus 1						**Abelmoschus 2**					
Control	4.67^a	10.83^a	13.67^a	21.61^a	27.02^a	27.67^a	7.02^a	15.02^a	17.67^a	17.52^b	20.67^b	25.02^b
Primed Dried	3.33^b	7.83^b	13.17^b	15.83^c	20.01^c	24.33^b	5.02^b	11.02^b	15.37^b	15.33^c	16.67^c	21.67^c
Primed Not Dried	3.01^b	6.83^c	12.02^c	18.02^b	22.67^b	26.33^a	6.01^a	13.51^a	19.02^a	24.51^a	35.67^a	39.33^a

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 3. Effects of hydro priming on height (cm)of *C. olitorius* 1. (NGB01284) 2. (NG/A0/02/11/007)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Corchorus.1						**Corchorus.2**					
Control	1.67^a	4.83^b	7.83^c	13.83^c	15.01^c	22.01^c	3.02^a	5.83^b	12.33^b	16.33^b	26.67^b	29.67^b
Primed Dried	2.67^a	8.83^a	21.33^b	25.51^b	30.33^b	36.33^b	2.83^a	8.52^a	21.67^a	29.33^a	37.57^a	37.67^a
Primed Not Dried	2.51^a	9.83^a	24.33^a	31.83^a	40.01^a	44.67^a	2.83^a	8.51^a	21.67^a	29.33^a	37.67^a	37.57^a

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 4. Effects of hydro priming on Leaf Number of *C. argentea* 1.(NGB01239) 2. (NHGB/09/09)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Celosia 1						**Celosia 2**					
Control	7.33^{b}	17.33^{c}	34.67^{c}	43.33^{c}	63.33^{c}	83.33^{c}	10.67^{a}	22.67^{b}	61.01^{c}	64.01^{c}	72.02^{c}	78.33^{c}
Primed Dried	10.02^{a}	27.33^{a}	73.01^{a}	83.33^{a}	87.33^{b}	94.33^{b}	9.01^{b}	25.33^{a}	88.67^{a}	103.00^{a}	108.00^{a}	125.30^{a}
Primed Not Dried	8.67^{a}	25.33^{b}	57.33^{b}	75.01^{b}	96.02^{a}	109.70^{a}	11.33^{a}	20.01^{c}	65.00^{b}	74.01^{b}	78.02^{b}	84.67^{b}

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table5. Effects of hydro priming on Leaf Number of *A. esculentus* 1. (NGB01186) 2. (NGB01190)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Abelmoschus 1						**Abelmoschus 2**					
Control	5.33^{a}	7.67^{a}	11.02^{c}	10.67^{b}	9.33^{b}	8.33^{c}	5.01^{a}	12.02^{a}	12.67^{b}	11.67^{b}	9.02^{b}	9.67^{a}
Primed Dried	5.33^{a}	6.67^{a}	12.03^{b}	12.03^{a}	10.33^{b}	11.02^{b}	4.33^{c}	10.67^{b}	9.01^{c}	6.67^{c}	7.02^{c}	7.67^{b}
Primed Not Dried	4.67^{a}	8.67^{a}	13.33^{a}	12.33^{a}	13.02^{a}	14.02^{a}	5.67^{a}	11.33^{b}	18.03^{a}	14.33^{a}	10.67^{a}	10.33^{a}

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 6. Effects of hydro priming on Leaf Number of *C. olitorious* 1.(NGB01284) 2. (NG/A0/02/11/007)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Corchorus.1						**Corchorus.2**					
Control	7.10^{c}	21.67^{c}	41.10^{b}	48.33^{a}	56.10^{b}	54.10^{c}	8.10^{c}	18.67^{c}	48.33^{c}	68.10^{b}	81.10^{b}	88.61^{b}
Primed Dried	12.33^{a}	29.33^{b}	41.20^{b}	47.33^{c}	55.10^{c}	74.33^{a}	8.67^{b}	32.67^{a}	50.10^{b}	57.67^{c}	70.33^{c}	76.10^{c}
Primed Not Dried	9.67^{b}	29.67^{a}	45.10^{a}	57.10^{b}	63.10^{a}	57.67^{b}	11.33^{a}	31.10^{b}	75.33^{a}	76.33^{a}	106.20^{a}	124.30^{a}

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 7. Effects of hydro priming on Leaf Area (cm^2) of *C. argentea* 1. (NGB01239) 2. (NHGB/09/09)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Celosia 1						**Celosia 2**					
Control	4.73^{a}	34.11^{a}	45.11^{a}	47.10^{b}	52.65^{b}	56.50^{b}	3.45^{c}	20.15^{b}	23.90^{b}	37.05^{b}	38.50^{b}	43.10^{b}
Primed Dried	3.57^{b}	27.47^{b}	30.63^{c}	31.6^{c}	36.86^{c}	39.63^{c}	5.70^{b}	38.33^{a}	48.77^{a}	53.63^{a}	60.70^{a}	66.73^{a}
Primed Not Dried	4.65^{a}	26.58^{b}	36.87^{b}	52.07^{a}	64.10^{a}	68.80^{a}	6.53^{a}	7.44^{c}	9.13^{c}	9.68^{c}	13.62^{c}	15.43^{c}

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 8. Effects of hydro priming on Leaf Area(cm^2) of *A. esculentus* 1. (NGB01186) 2. (NGB01190)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Abelmoschus 1						**Abelmoschus 2**					
Control	24.45^{a}	65.12^{c}	89.55^{b}	93.85^{c}	99.50^{b}	103.00^{c}	25.00^{b}	52.50^{b}	59.60^{b}	61.90^{b}	76.50^{b}	80.65^{b}
Primed Dried	19.17^{b}	82.67^{b}	125.93^{a}	130.70^{a}	139.77^{a}	146.03^{a}	14.40^{c}	32.93^{c}	35.93^{c}	40.71^{c}	55.67^{c}	60.60^{c}
Primed Not Dried	12.58^{c}	120.67^{a}	87.27^{c}	96.17^{b}	99.17^{c}	112.3^{b}	29.33^{a}	74.07^{a}	97.11^{a}	105.80^{a}	110.23^{a}	116.16^{a}

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Table 9. Effects of hydro priming on Leaf Area (cm^2) of *C. olitorious* 1. (NGB01284) 2. (NG/A0/02/11/007)

TREATMENT	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
	Corchorus.1						**Corchorus.2**					
Control	4.25^{b}	6.75^{c}	8.80^{c}	9.56^{c}	10.67^{c}	11.59^{c}	2.75^{a}	6.25^{b}	15.05^{a}	15.55^{a}	16.50^{b}	17.20^{a}
Primed Dried	3.83^{b}	10.40^{b}	13.53^{b}	16.50^{b}	18.27^{b}	25.37^{b}	1.45^{b}	9.97^{a}	13.97^{a}	15.03^{a}	17.17^{a}	12.95^{c}
Primed Not Dried	5.50^{a}	16.17^{a}	25.33^{a}	27.87a	28.87^{a}	33.30^{a}	2.83^{a}	6.47^{b}	9.67^{b}	12.21^{b}	14.33^{c}	16.50^{b}

Means in the same column having the same letter(s) superscript are not significantly different at P<0.05

Discussion

Results revealed that the effects of hydropriming were significant on the vegetative growth parameters of these three vegetables used for the experiment (*Celosia argentea, Corchorus olitorius* and *Abelmoschus esculentus*). The different accessions of each vegetables responded differently to the varied priming treatments, this is in accordance with the work of Gregory *et al.* (1998) which reported that the degree of enhancement from priming depends upon the initial quality of the seed, the species being treated, and treatment conditions such as temperature, water potential, duration, and other conditions specific to the priming medium.

Plant height: This increased most with primed seeds as seen in tables 1, 2 and 3. Priming and re- drying favoured increase in stem height for *Celosia* 1 while Celosia 2 responded poorly to priming treatments. *Abelmoschus* 1 also responded poorly to priming treatments while *Abelmoschus* 2 and *Corchorus* 1 had increased stem heights with primed not dried seeds, *Corchorus 2* had the most increase with primed dried seeds.

Number of Leaf: This also increased most with primed seeds (tables 4 – 6) and this was most favourable for leafy vegetables which were grown mainly for their leaves. *Celosia* 1 and 2 had more increase with primed dried seed and this was similar to *Abelmoschus* 1, *Abelmoschus* 2 increased more in leaf number with primed not dried seeds. *Corchorus* 1 had increased values which varied between primed dried and primed not dried seeds while priming without re-drying favored *Corchorus* 2. This is in line with (Chivasa *et al.*, 2000), who reported that hydro primed seeds of sorghum had significantly more plants and produced more number of leaves.

Leaf area: The primed not dried seeds of *Celosia* 1 had larger leaf area while Celosia 2 increased more with primed dried seeds similar to *Abelmoschus* 1, Abelmoschus 2 had more increase in leaf area with primed not dried seeds. Priming without re-drying also favoured Corchorus 1 while Corchorus 2 had values that varied between control and primed seeds. This was in accordance with the observations of (Harris *et al.*, 2002) who reported that hydro priming effects persisted only till early vegetative growth of maize and failed to improve the leaf area. Also (Ahmad and Shad, 2010) suggested that priming of seeds prior to sowing has key role in improving crop growth during seedling development and consequently affects crop leaf area.

With regards to the above results, it can be seen that priming treatments particularly hydropriming is favourable for increase in vegetative growth of vegetables but to achieve best results with priming, specific priming conditions of each species of interest must be determined.

Conclusion

In conclusion, seed priming with water (hydro priming) increased the growth parameters of the vegetables such as, plant height, number of leaves and leaf area. Therefore, hydro-priming is a simple, low cost and environmentally friendly technique for improving *Corchorus olitorius, Celosia argentea* and *Abelmoschus esculentus* growth and development. This method of pre-planting treatment could be of great potential and promising in vegetable production.

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