IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 15, Issue 10 Ser. II (October 2022), PP 36-42
www.iosrjournals.org

Seed Viability Response of Cowpea Ontypes of Solvent Concentrations of Water Hyacint Root Extract

Raihani Wahdah[1], Hikma Ellya[2]
[1]*Department of Agronomy, Lambung Mangkurat University, Banjarbaru, 70714, Indonesia*
[2]*Department of Agroechotechnology, Lambung Mangkurat University, Banjarbaru, 70714, Indonesia*

Abstract:
Background*: Cowpea seeds are susceptible to seed deterioration during storage. Therefore, a treatment is needed to improve the viability of the seeds, including in the form of seed invigoration by seed priming. The purpose of this study was to study the effect of the type of water hyacinth root extract on the viability of cowpea nagara seeds and determine the best concentration for its effect on viability of nagara cowpea seeds.*
Materials and Methods*: The experiment was carried out in April - November 2022 at the Plant Physiology Laboratory, Faculty of Agriculture, ULM Banjarbaru which arranged in a Nested Design repeated 3 times. Five levels of concentrations nested in 2 types of solvent. The observed variables were percentage of normal seedling at the age of 5 days after sowing (NS 5 DAS), percentage of germinated seeds at 5 DAS (% GS 5 DAS), percentage of seed germination (SG), height of seedling at 8 DAS, and dry weight of shoot of normal seedling height at 8 DAS. The data were analyzed with analysis of variant or Friedman Test.*
Results*: There was a significant effect of the concentration of water hyacinth root extract in methanol solvent, but not significant in water solvent, namely at NS dan GS 5 DAS, height at 8 DAS, and dry weight of shoot of normal seedling, but no treatment which better than control.*
Conclusion: *The 2.5 % concentration of water hyacinth root extract at methanol solvent was able to increased seed germination compared to the control without priming from 29.33% to 38.67%. Root of water hyacinth extracted with water as solvent gave higher dry weight of shoot of normal seedling compared to methanol solvent (0.7879 g and 0.5370 g)*
Key Word*: water hyacinth root extract, cowpea, kind of solution, concentration, seed viability*

Date of Submission: 25-10-2022 Date of Acceptance: 06-11-2022

I. Introduction

Cowpea is a family of legumes that have high nutritional value. Cowpea protein content is 11.21-34.91%, carbohydrates 31.11-54.02%, crude protein (prebiotics) 3.94-22.12%, fat (0.81-5.42%), iron (0.89-65.21 mg / 100 g), calcium (1.50-16.15 mg / 100 g), phosphorus (171.55-554.01 mg / 100 g), magnesium (0.26 - 1658.84 mg/ 100 g), potassium 1.03-13,445.25 mg / 100 g and sodium /0.13-2.21 mg / 100 g)[1].Cowpea leaves are rich in beta-carotene and iron, i.e. 0.25–36.55 and 0.17–75.00 mg/100 g leaf dry weight[2]. As a high protein seed, it is susceptible to seed deterioration during storage. Therefore, a treatment is needed to improve the viability of the seeds, including in the form of seed invigoration, which is an effort to maximize the potential for seed viability by seed priming.

Priming of seeds with various materials was reported to be able to improve the performance of seed viability. Biopriming in the form of Plant Growth Promoting Regulation (PGPR) had a significant effect on increasing viability of rice seeds[3], hydropriming of cowpea seeds[4-8]. The positive effect of osmopriming with NaCl on cowpea seeds also was reported [4].Thepositive effect of osmopriming with Poly Ethylene Glycol (PEG) on nagara cowpea seeds were reported [5-6].Priming of nagara cowpea seeds with water hyacinth root extract improves seed viability performance[7-9]. Thepositive effect of water hyacinth root extract on longan seed viability was reported [10].

In addition to being able to improve the performance of seed quality with invigoration techniques, priming materials are also needed which are easy to obtain (available in abundance in nature) and inexpensive. Dried water hyacinth root powder dissolved in water had a positive effect on cayenne pepper[11] as well as extracts with aquadest as a solvent[12]. Root of water hyacinth extracted with water was better than aquadest solvent, and aquadest solvent was better than powder dissolved in water. The concentration of 7.5% and 15.0% in water solvent was better than 22.5% and 30.0%[9]. The use of methanol as a solvent in the noni fruit extraction process gave a better response than water solvent to reduce the percentage of viability of rumen protozoa and total gas production in vitro was reported[13]. Further observations are needed on the nagara cowpea seeds applied with some concentration of 2 types of water hyacinth root extract.

The purpose of this study was to examine the effect of the type of water hyacinth root extract on the viability of cowpea nagara seeds and determine the best concentration for its effect on viability of nagara cowpea seeds.

II. Material And Methods

The experiment was carried out in April - November 2022 at the Plant Physiology Laboratory, Faculty of Agriculture, University of Lambung Mangkurat Banjarbaru, and the Greenhouse of BPSBTPH of South Kalimantan. The materials used were cowpea nagara seeds, water hyacinth root extract (methanol and water solvent), tub, sand, sand sieve, basin, seed soaking jar, oven, scales, ruler, and equipment for test of seed viability in sand media.

The experimental arranged in a Nested Design repeated 3 times. Concentrations (2.5%, 5.0%, 7.5%, 10.0%, 12.5%, and 15.0%) nested in the type of solvent (methanol and water) The experiment also included a control without priming (WP) and a control 0.0 %. The required number of seeds are soaked according to the treatment for 3 hours, drained, then sown on sand media. The observed variables were percentage of normal seedling at the age of 5 days after sowing (NS 5 DAS), percentage of germinated seeds at the age of 5 days after sowing (% GS 5 DAS), percentage of seed germination (SG), height of seedling at the age of 8 days after sowing, and dry weight of shoot of normal seedling height at the age of 8 days after sowing.

The data were tested for homogeneity of variance with the Bartlett Test. Variance Analysis (Anova) were carried out following an additive linear model, namely:

$Yijk = \mu + \alpha i + \beta j(i) + + \varepsilon(ij)k$

If there was an effect of treatment based on analysis of variance, then the test is continued with the Least Significant Difference Test (LSD) at a significant level of 5%, as follows:

$LSD = t\alpha/2\ KTG/r$

LSD = smallest real difference value

$t\alpha/2$ = t table value in db error

KTG = mean square of error

r = repetition

Parametric test, namely Fiedman Test were performed if the data did not meet the requirements for parametric test. If the Friedman test showed a significant difference, then the Friedman multiple comparison test was continued :

$A2 = \sum_{i=1}^{k} \sum_{j=1} [R(Xij)]2$; [R(Xij] = rating of each experimental units

$B2 = 1/b \sum_{j=1} Rj2$; b = number of repetition ; Rj2 = number of rating of repetitions

$T2 = \{(b-1)[B2- bk(k+1)2/4]\} / (A2-B2)$;

According to Conover (1980), F value on db1=k1=k-1= 7 and db2=k2=(b-1)(k-1)=14 at 5 % level is 2.76 (A.26 Table). There are the treatment effect if T2 >2.76.

Multiple comparison of Friedman Test is as follows ::

$T_{0.975} = \sqrt{\frac{[2b(A2 - B2)}{(b-1)(k-1)}}$ If value of $T_{0.975}$< differenceof 2 treatments, then 2 difference are not significantly

III. Result

Percentage of Normal Seedling at the age of 5 days after sowing (% NS 5) DASand Percentage of Germinated Seeds at the age of 5 days after sowing(% GS 5 DAS)

Friedman test was used in data analysis of % NS and % GS 5 DAS, because it did not meet the requirements of the parametric test. There was a significant effect of the concentration of water hyacinth root extract in methanol solvent, but not significant in water solvent. Multiple comparison test of Friedman test for these two variables in methanol solvent can be seen in Table 1.

Table 1. Result of multiple comparisons of concentration treatment on the type of methanol solvent based on Friedman's test on % NS 5 DAS and % GS 5 DAS

Concentration	% NS 5 DAS	% GS 5 DAS
Without Priming (WP)	(29.33)20.0cd	(32.00) 20.0cd
c_0 (0.0 %)	(35.33)21.0d	(35.33) 22.0d
c_1 (2.5 %)	(30.67) 21.0d	(34.00) 20.0cd

c_2 (5.0 %)	(21.33) 15.0bcd	(22.67) 15.0bc
c_3 (7.5 %)	(14.67) 13.0bc	(19.33) 13.0bc
c_4 (10.0 %)	(3.33) 9.0ab	(4.00) 9.0ab
c_5 (12.5 %)	(0.00) 4.5a	(0.00) 4.5a
c_6 (15.0 %)	(0.00) 4.5a	(0.00) 4.5a

Note: the same letter behind the number in each variables were not significantly different; the number outside the brackets were the rating number while the number inside the brackets were the original number

A significant decrease in % NS 5 DAS compared to the WP treatment occurred from the concentration of water hyacinth root extract at 7.5%, namely from 29.33% to 21.33%. The control treatment of 0.0% and 2.5% of water hyacinth root extract showed a higher % NS 5 DAS value than WP, namely 35.33% and 30.67% respectively, although it did not showed a significant difference. Percentage of NS 5 DAS in the 10% treatment was not significantly different from the 5.0% and 7.5% treatments, but was not better than the 12.5% and 15.0% treatments.

Alike to % NS 5 DAS, was also seen in the % GS 5 DAS. There was no significant difference between the WP treatments to 0.0%, 2.5%, 5.0%, and 7.5%. Priming with a concentration of 2.5% was only better than a concentration of 10.0% - 15.0%. However, like % GS 5 DAS, there was a tendency that the % NS 5 DAS which treated with water priming (0.0%) tended to be better than WP, with values of 35.33% and 32.00%, respectively (Table 1).

Based on data on this experiment, it appears that although water hyacinth root extract in methanol solvent showed a significant effect, it was not able to improve the % NS 5 SAP and % GS 5 SAP. That was thought to be caused by a very low initial viability, which was indicated by the WP treatment. as a control, namely 29.33%. The seeds of nagara cowpea used in this study were seeds harvested by farmers in September 2021 which were purchased in April 2022 (7 months after harvest).

The percentage of seeds germinating at the age of 5 days after sowing (% SG 5 DAS) illustrated the potential for seed germination. The value which not so different from the normal seedling at the age of 5 days after sowing (% NS 5 DAS), indicated that the potential for seed germination was indeed low (Table 1).

Seed Germination (SG)

The analysis of variance of seed germination using control WP showed that treatment, concentration in methanol solvent (C|j2) had a very significant effect, control vs. treatment had a significant effect, while the type of solvent and concentration in the type of water solvent (C|j1) had no significant effect. Analysis of variance with 0.0% control showed that the treatment, concentration in type (C|J) had a very significant effect, while control vs. treatment, type and concentration in water solvent (C|j2) did not have a significant effect. No significant different between the WP and the treatment (Table 2).

Table 2. Result of LSD test at comparison between control without priming (WP) with the average treatment on seed germination

Percentage of Seed Germination (%)							
WI	Mean of Treatment	$c_1\|j_1$	$c_2\|j_1$	$c_3\|j_1$	$c_4\|j_1$	$c_5\|j_1$	$c_6\|j_1$
5.77b (29.33)	4.80a (20.56)	4.72a (18.67)	5.09b (22.00)	5.06b (22.00)	5.42b (25.33)	4.61a (18.00)	5.05b (22.00)
		$c_1\|j_2$	$c_2\|j_2$	$c_3\|j_2$	$c_4\|j_2$	$c_5\|j_2$	$c_6\|j_2$
		6.53c (38.67)	6.07b (33.33)	4.35a (15.33)	3.05a (5.33)	3.60a (10.00)	3.12a (7.33)

Note: The b letter showed that it was not significantly different from the control; c = higher than control; a = lower than control

On average, it appears that the control was better than the treatment. There are treatments that are not significantly different from the control, namely c2|j1 (22.00 %), c3|j1 (22.00 %), c4|j1 (25.33 %), c6|j1 (22.00 %), and c2|j2 (33.33%). There was one treatment that was better than WP, namely c1|j2 (38.67 %), one treatment which was equivalent to WP, namely c1|j2 (33.33%) while the others had a lower germination values than the control (5.33% - 15.33 %). LSD test of the effect of concentration in methanol solvent on seed germination can be seen in Table 3.

Table 3. Result of LSD test for comparison of concentration in water solvent (C|j2) for the percentage of seed germination

$C\|j_2$ Based on Anava with 0.0 % as control					
$c_1\|j_2$	$c_2\|j_2$	$c_3\|j_2$	$c_4\|j_2$	$c_5\|j_2$	$c_6\|j_2$
6.53c (38.67)	6.07c (33.33)	4.35b (15.33)	3.05a (5.33)	3.60ab (10.00)	3.12a 7.33)

C|j_2 Based on Anava with WP as control					
$c_1|j_2$	$c_2|j_2$	$c_3|j_2$	$c_4|j_2$	$c_5|j_2$	$c_6|j_2$
6.25c	5.77c	3.91b	2.41a	3.01b	2.27ab
(38.67)	(33.33)	(15.33)	(5.33)	(10.33)	(7.33)

Note: the same letter in C|j_2 based on ANOVA at WP control or C|j_2 at 0.0 % control was significantly different from the control at 5% level; numbers in ( ) was the real numbers; the number outside ( ) was the square root transformation x +4 for control 0.0 % and $\sqrt{x+0.5}$ for control WP

Based on Table 3, it appears that the concentrations of 2.5% and 5.0% showed better seed germination values (38.67 % and 33.33 %) compared to concentrations of 7.5% - 15.0%. There was no difference in the germination value at concentrations of 10.0%, 12.5%, and 15.0%.

The Seedlings Height at The Age at 8 Days After Sowing (Seedling Height 8 DAS)

Like % NS and % GS 5 DAS, the height of seedlings at the age of 8 days after sowing (seedlings height 8 DAS) also did not meet the requirements for the parametric test, so the Friedman Test was carried out. There was an effect of concentration on the on the seedlings height 8 DAS in methanol solvent, but not in water solvent. Multiple comparison test of Friedman test can be seen in Table 4.

Table 4. Result of multiple comparisons of concentration treatment on methanol solvent based on the Friedman test at the seedlings height 8 DAS

TR	c_0 (0.0 %)	c_1 (2.5 %)	c_2 (5.0 %)	c_3 (7.5 %)	c_4 (10.0 %)	c_5 (12.5 %)	c_6 (15.0 %)
(26.94)	(26.42)	(24.50)	(23.19)	(19.63)	(23.79)	(9.17)	(8.17)
21b	21b	18ab	10ab	7ab	9ab	9a	9a

Note: the same letters behind the numbers was not significantly different; the number outside ( ) was the rating number, while the number ( ) was the original number

Table 4 showed that application of water hyacinth root extract concentration up to 10.0% was not able to increased seedling height 8 DAS. A significant decrease compared to the control WP and 0.0% occurred at a concentration of 12.5% - 15.0%.

Dry Weight of Shoot of Normal Seedling

In the analysis of variance of dry weight of shoot of normal seedlings, which WP as control showed that treatment P, type of solvent, concentration in methanol solvent (C|j2) had a very significant effect, while control vs. treatment and concentration in water solvent (C|j1) not significant. Analysis of variance which 0.0% as control showed that treatment, control vs. treatment, type of solvent, concentration in methanol solvent (C|j2) had a very significant effect, while concentration in water solvent (C|j1) had no significant effect. The LSD test showed that no different effect between WP and the treatment (Table 5).

Table 5. Result of LSD test for comparison of control and treatment for the dry weight of shoot of normal seedlings

Dry Weight Of Shoot Of Normal Seedlings (g)							
Control (0.0 %)	Treatment	$c_1|j_1$	$c_2|j_1$	$c_3|j_1$	$c_4|j_1$	$c_5|j_1$	$c_6|j_1$
1.0538b	0.7341a	4.8398a	0.9418b	0.8866a	0.9332b	0.8001a	0.8655a
(1.1140)	(0.6092)	(0.7277)	(0.8973)	(0.7930)	(0.8827)	(0.6613)	(0.7717)
		$c_1|j_2$	$c_2|j_2$	$c_3|j_2$	$c_4|j_2$	$c_5|j_2$	$c_6|j_2$
		0.9905b	0.9471b	0.6344a	0.4615a	0.0949a	0.0937a
		(0.9830)	(0.9173)	(0.4153)	(0.2140)	(0.0270)	(0.0263)

Note: the same letter as the letter behind the number on the control (b) showed that it was not significantly different from the control; c = higher than control; a = lower than control

Table 5 showed that several treatments were different from each others, but there was no treatment that could increased the dry weight of shoot of normal seedlings compared to 0.0% control. On average, it appears that the dry weight of shoot of normal seedlings in the control was better than the treatment. However, if you look at each treatment, there were treatments that were not significantly different from the control, namely $c_2|j_1$ (0.8973 g), $c_4|j_1$ (0.8827 g), $c_1|j_2$ (0.9870 g), and $c_2|j_2$. (0.9173 g).

The LSD test on the effect of the type of solvent on the dry weight of shoot of normal seedling can be seen in Table 6.

Table 6. Result of :LSD test for comparison between water solvent (j_1) with methanol solvent (j_2) for the dry weight of shoot of normal seedlings

Type of Solvent	Dry Weight of Shoot of Normal Seedlings (g)
Water (j_1)	0.8778b(0.7879)
Methanol (j_2)	0.5370a(0.4305)

Notes: different letters showed differences at the 5% level; the number outside ( ) was the transformation number of $\sqrt{x}$; number ( ) was the original number

Root of water hyacinth extracted with water as solvent gave higher dry weight of shoot of normal seedling compared to methanol solvent (0.7879 g and 0.5370 g respectively). However, there was no effect of concentration at the water solvent and the contrary there was an effect of concentration at the methanol solvent. Result of LSD test for the effect of concentration in methanol solvent ($C|j_2$) on the dry weight of shoot of normal seedling can be seen in Table 7.

Table 7. Result of LSD test for comparison of concentrations in methanol solvent ($C|j_2$) for the dry weight of shoot of normal seedling

$c_1\|j_2$	$c_2\|j_2$	$c_3\|j_2$	$c_4\|j_2$	$c_5\|j_2$	$c_6\|j_2$
0.9905d	0.9471d	0.6344c	0.4615b	0.0949a	0.0937a
(0.9810)	(0.8969)	(0.4024)	(0.2130)	(0.0090)	(0.0088)

Notes: the same letter in $C|j_2$ was not significantly different from the control at the 5% level; the number ( ) were original number; the number outside ( ) were the the transformation number to $\sqrt{(x+0.5)}$

Table 7 showed that the concentration of 2.5% and 5.0% in water solvent had a dry weight of shoot of normal seedling was not significantly different (0.9810 g and 0.8969 g, respectively) and both were higher than the dry weight of shoot of normal seedling at the concentration of water hyacinth root extract 7.5% (0.4024 g). The dry weight of shoot of normal seedling at a concentration of 10.0% water hyacinth root extract (0.2130 g) was higher than at a concentration of 7.5% (0.4024 g). It was also seen that the concentrations of 12.5% and 15.0% showed a dry weight of shoot of normal seedling was not significantly different (0.0090 g and 0.0088 g, respectively) and both were lower than the other treatments.

IV. Discussion

The low seeds viability in this experiment was thought to be related to the length of storage of the seeds and the moisture content of the seeds when the seeds were stored in the farmer. The initial moisture content of the seeds when purchased from farmers was 11.82%. For example, the required moisture content for local soybeans is 11.0%[14]. Referring to soybeans, the moisture content of cowpea during storage (before planting) should be < 11.0%. Soybean seeds stored with moisture content of 8% and 10% in polyethylene plastic bags and aluminum foil bags can maintain high quality for 6 months of storage[15]. This implies that if the moisture of seeds is > 10%, the viability of the seeds will decrease if they are stored for or more than 6 months. .

The low initial seeds viability causes the seeds could no longer activate the enzymes needed for optimal germination, even though water hyacinth root extract had been given which according to some researchers can improve the performance of seed quality. As a result, at the age of 5 DAS, the growth of seedlings (indicated by percentage of normal seedlings and the persentage of germinated seeds) was not significantly different from the seeds that without priming (WP) or hydropriming (0.0% extract). Even at a concentration of 12.5% – 10.0%, it caused a decrease in the value of the observed variables. Seed deterioration had implications for the low physiological quality of seeds. Seed deterioration is a combination of physiological and ultra-structural abnormalities of seeds which include changes in the protoplasm, cell nucleus, mitochondria, plastids, ribosomes, and lysosomes[16].

On average, it appears that the control was better than the treatment. However, if you look at each treatment, then there are treatments that were not significantly different from the control, namely c2|j1 (22.00 %), c3|j1 (22.00 %), c4|j1 (25.33 %), c6|j1 (22.00 %) , and c2|j2 (33.33%). Wahyuni et al. (2020) reported that in rice seeds, the control (without treatment) had 98.5% germination not significantly different from the treatment of 10 ppm GA 3 + 15 ppm kinetin (97.5%) and immersion in water (98.5%)[17].

Even though the 2.5 % concentration of water hyacinth root extract at methanol solvent was able to increased seed germination compared to the control without priming from 29.33% to 38.67% (Table 2), much lower than the minimum standard of seed germination of soybean seeds. The minimum standard for germination of soybean seeds for extention seed (ES), the first – 4th offspring of ES (BR1 to BR4), and local varieties were 65%[14]. The value of seed germination at a concentration of 2.5% was not significantly different from a concentration of 5.0%, namely 33.33 % (Table 2). The result of this study was in concordance with other research which stated that increasing vigor and viability of deterioration seeds can be done by using seed invigoration techniques, such as by soaking the seeds in a certain material[18-20]. Soaking seeds in gibberellic

acid solution were able to increase the germination of some seeds with various degrees of deterioration. The concentration used depends on the type and degree of seed deterioration[21-22].

The low germination of the seeds in the water hyacinth root extract treatment in this study was thought to be due to the low initial quality of the seeds used. The value of germination in the WP as control treatment was only 29.33%, so that even though water hyacinth root extract was treated, it could not achieve the minimum requirements for seed germination, although there was an increase in seed germination in the 2.5% treatment of water hyacint root extract (Table 2).

The treatment of water hyacinth root extract 7.5% and 15.0% in water solvent were better than the treatment of 22.5% and 30.0%. The best treatment in distilled water was 7.5% water hyacinth root extract. However, only water hyacinth root extract concentration treatment of 15.0% in water was able to increase seed germination up to 80.67%[8]. The difference response of seed germination on the concentration of water hyacinth root extract between the 2021 and 2022 studies is thought to be caused by differences of the solvent used in the preparation of the extract, in addition to the low initial vigor of the seeds.

The positive effect of water hyacinth root extract, on seeds of *Pinus roxburghii* and *Bauhinia purpurea*[23], on spinach seeds expired for 1 month but not for 6 months[24]. Improvements in the number of wheats germinated seed in organic fertilizer treatment with water hyacinth root extract [25]. The germination of sapodilla seeds increased from 16.67% at 0 ppm extract to 80.55% at 500 ppm[10]. There was an interaction between water hyacinth root extract concentration and genotype. The best water hyacinth root extract was given at a concentration of 15.0% in the KT 9 genotype[26].

In line with the results of this study, there was a decrease in seed quality due to invigoration of low vigor hanjeli (*Coix lacryma*–jobi L.) seeds[27]. The results of their experiments showed that invigorating the seeds with hot water at a temperature of around 70°C, reduced the seeds germination from 50.67% (control) to 25.33% (treatment). The decrease did not occur in high vigor seeds (early germination 90.67 %). The same thing was also reported that the treatment of 0.04% streptomycin sulfate + 0.01% benomyl in the seed treatment caused a decrease in seed germination compared to the control, from 98.5% to 89.5%[17]. The invigoration treatment of several concentrations of NAA and bean sprout extract on apple cucumber seed germination[28].

Besides being described by seed germination, seed quality is also described by seed vigor. Seed height is one of the seed vigor variables. A decrease in vigor leads to seed death, but loss of vigor occurs before losing the ability to germinate [29]. This implies that the vigor has decreased when the germination power is still high. Seed treatment with matri-conditioning plus *Rhizobium sp*. and fungicides can increase the vigor index of bambara beans[30].

Loss of seed vigor is associated with a decrease in the ability of the seeds to carry out all physiological functions that occur until they appear to be normal seedlings. The decrease in seed vigor can be seen from the progressive changes in membrane integrity, enzyme activity and protein synthesis. These biochemical changes can occur very quickly (several days) or slowly (years), depending on genetic factors and the production environment that are not yet fully understood [29]. This could explain, that based on the height of shoot of normal seedling at 8 DAS, it showed the inability of the seedlings to perform better than the control, while on the variable of seed germination, the positive effect of water hyacinth root extract could be seen at a concentration of 2.5%.

The dry weight of shoot of normal seedlings increased from the control 0.33 g to 0.49 g on the average treatment [7]. Water solvent was better than distilled water, and distilled water was better than powder dissolved in water[9].

The low seed viability may be related to membrane damage and due to prolonged imbibition. Seed imbibition that exceeds the capacity of its needs, will cause a decrease in seed viability, even cause seed death[31]. Ruliyansyah (2011) stated that imbibition in low viability seeds will take place quickly and cause cell membrane leakage. Membrane damage does not occur if the seeds have high viability[32].

V. Conclusion

1. There was a significant effect of the concentration of water hyacinth root extract in methanol solvent, but not significant in water solvent, namely at NS dan GS 5 DAS, height at 8 DAS, and dry weight of shoot of normal seedling, but no treatment which better than control.
2. The 2.5 % concentration of water hyacinth root extract at methanol solvent was able to increaseseed germination compared to the control without priming from 29.33% to 38.67%.
3. Root of water hyacinth extracted with water as solvent gave higher dry weight of shoot of normal seedling compared to methanol solvent (0.7879 g and 0.5370 g respectively)

References

[1]. Enyiukwu, D.N., Amadioha, A.C., Ononuju, C.C. Biochemical composition, potential food and feed values of aerial parts of cowpea (*Vigna unguiculata* (L.) Walp.). Greener Trends. Food Sci Nutr. 2018; :11–8. doi: 10.15580/gtfsn.2018.1.080118107

[2]. Owade, J.O., Abong, G., Okoth, Mm, Mwan,g A.W. A review of the contribution of cowpea leaves to food and nutrition security in East Africa. Food Sci Nutr. 2019; 8,36–47. doi: 10.1002/fsn3.1337.

[3]. Wahdah, R., Arisandi, N., & Noor, A. Penggunaan Plant Growth Promoting Rhizobacteria (PGPR) Untuk Perbaikan Performa Viabilitas Benih Beberapa Varietas Padi (*Oryza sativa* L.) Setelah Penyimpanan Selama Tiga Bulan. Prosiding Seminar Nasional Lingkungan Lahan Basah, 2017; 3(1), 86-95.

[4]. Eskandari, H., & Kazemi, K. Effect of Seed Priming on Germination Properties and Seedling Establishment of Cowpea (*Vigna sinensis*). Notulae Scientia Biologicae, 2011; 3(4), 113-116.

[5]. Wahdah, R., & Susanti, H. Respon Viabilitas Benih Kacang tunggak nagara (*Vigna unguiculata ssp. cylindrica*) terhadap Invigorasi Benih Menggunakan PEG (Poli Etilen Glikol). Prosiding Seminar Nasional Lingkungan Lahan Basah, 2019; 4(1), 117-125.

[6]. Wahdah, R., & Susanti, H. Respon Viabilitas Benih Kacang Nagara (*Vigna unguiculata Ssp. cylindrica*) terhadap Osmoconditioning Dengan PEG (Polietilen Glikol) Pada Beberapa Lama Perendaman. Prosiding Seminar Nasional Lingkungan Lahan Basah, 2020; 5(3), 143-151.

[7]. Wahdah, R., Ellya, H., & Hairina, H. Respon Viabilitas Benih Kacang Tunggak Nagara (*Vigna unguiculata ssp cylindrica*) Akibat Pemberian Konsentrasi Ekstrak Akar Eceng Gondok (*Eichhornia crassipes*). Rawa Sains, 2020; 10(2), 63-73. Retrieved from http://garuda.ristekbrin.go.id/documents/detail/1868268

[8]. Wahdah, R., Ellya, H., & Kurniawati, E. Pengaruh lama priming dengan ekstrak akar eceng gondok (*Eichornia crassipes*) terhadap viabilitas benih kacang tunggak nagara (*Vigna unguiculata ssp. cylindrica*). Prosiding Seminar Nasional Lingkungan Lahan Basah 2020; 6(3),9

[9]. Wahdah, R. and Ellya, H. Application of concentration and kinds of solution roots of water hyacinth (*Eichhornia crassipes*) to increase the seed quality performance of cowpea (*Vigna unguiculata ssp. cylindrica*). IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 2021; 14(10):31-40.

[10]. Ummah, K., & Rahayu, Y. S. The Effect of Gibberellin Extracted from Eichhornia crassipes Root on the Viability and Duration of Hard Seed Germination. Mathematics, Informatics, Science and Education International Conference (MISEIC) 2019. 1417, p. 012037. Surabaya: IOP J. Phys.: Conf. Ser.

[11]. Windarti, F., & Sopandi, T. Reduksi Jumlah Biji Cabai Rawit (*Capsicum frutescents*) dengan menggunakan Sari Akar Eceng Gondok (*Eichhornia crassipes*). Stigma, 2018; 11(2), 43-51.

[12]. Andriani, V. (2020). Potensi ekstrak akar Eceng Gondok (*Eichornia crassipes*) terhadap buah dan biji Cabai Rawit (Capsicum frutescents L.). Simbiosa, 2020; 9(1), 12-21. doi: 10.33373/sim-bio.v9i1.2305.

[13]. Ramdani, D., Marjuki, & Chuzaemi, S. Pengaruh Perbedaan Jenis Pelarut Dalam Proses Ekstraksi Buah Mengkudu (Morinda Citrifolia L.) Pada Pakan terhadap Viabilitas Protozoa dan Produksi Gas In-vitro. Jurnal Ilmu-Ilmu Peternakan, 2017; 27(2), 54-62. doi:10.21776/ub.jiip.2017.027.02.07 54

[14]. Ministry of Agriculture, R.I., Kementerian Pertanian, R.I. Keputusan Menteri Pertanian Republik Indonesia Nomor : 991/HK.150/C/05/2018 Tentang Petunjuk Teknis Sertifikasi Benih Tanaman Pangan. 2018;Kementerian Pertanian R.I., Jakarta. 2018

[15]. Tatipata, A., Yudono, P., Purwantoro, A., dan Woerjono, M. Kajian aspek fisiologi dan biokimia deteriorasi benih kedelai dalam penyimpanan. Ilmu Pertanian. 2004; 11(2), 76-87.

[16]. Fikri, M. N., Zuhry, E. dan Nurbaiti. Uji daya hasil dan mutu fisiologis benih beberapa genotife sorgum manis (*Sorghum bicolor* (L.) Moench) Koleksi Batan. Jonline Mahasiswa Faperta UNIV.Riau.2015; 2(1),1-11.

[17]. Wahyuni, S. Susanti, Z dan Yajid, A. Pengaruh perlakuan benih terhadap mutu fisiologis benih dan pertumbuhan bibit padi. Prosiding Seminar Nasional Kesiapan Sumber Daya Pertanian dan Inovasi Spesifik Lokasi Memasuki Era Industri 4.0, 2020; 567-576

[18]. Copeland, L.O., and McDonald, M.B. Principles of Seed Science and Technology. Burgess Publ. Co. 2004; Minneapolis, Minnesota.

[19]. Cox, W.J., Shields,E.. Cherney, D.J.R. and Cherney, J.H. Seed-applied insecticides inconsistenly affect corn forage in continuous corn. J.Agro, 2007; 99(-), 1640-1644.

[20]. Cox, W.J., Shields, E., and Cherney, J.H. Planting date and seed treatment effects on soybean in the Northeastern United States. J.Agro, 2008; 100(-),1662-1665.

[21]. Balaguera-Lopez, H.E., Deaquiz, Y.A. and Herrera, J.G.A. Obtention of tomato seedlings (*Solanum lycopersicum* L.) from seeds imbibited in different concentrations of gibberellic acid (GA3). Agron. Colomb. 2009; 27(1),- - -

[22]. Hedden, P. and Sponsel, V. A Century of Gibberellin Research J. Plant Growth Regul., 2015; 34, 740–760. DOI 10.1007/s00344-015-9546-1

[23]. Poudel, D., Mandal, R. A., & Ghimire, R. P. Effects of Leaves Extract of Eichhornia crassipes on Seed Germination and Seedling Growth of *Pinus roxburghii* and *Bauhinia purpurea*. Journal of Aquatic Science and Marine Biology, 2018; 1(2), 13-19.

[24]. Sagita, E.R. dan Rahayu, Y.S.Invigorasi benih bayam (*Amaranthus sp.)* dengan ekstrak akar eceng gondok. LenteraBio, 2022; 11(2), 326-340. https://journal.unesa.ac.id/index.php/lenterabio/ index

[25]. Vidya, S., & Girish, L. Water hyacinth as a green manure for organic farming. International Journal of Research in Applied, Natural, and Social Sciences, 2014; 2(6), 65-72.

[26]. Wahdah, R., Ellya, H., Auliani, R. Respon viabilitas benih dua genotipe kacang tunggak terhadap konsentrasi sari akar eceng gondok. Prosiding Seminar Nasional Lingkungan Lahan Basah, 2022; 7 (3,: 22-30.

[27]. Sumadi andNurmala,T. Pengaruh invigorasi benih hanjeli (*Coix lacryma*–jobi L.) terdeteriorasi terhadap mutu fisiologis serta dampaknya terhadap hasil. Jurnal Kultivasi, 2019; 18 (3): 1010-1014.

[28]. Rosita,A., Sugiono,D., dan Azizah, E. Invigorasi benih timun apel (*Cucumis melo* L.) dengan kombinasi zat pengatur tumbuh NAA (Naphtaleine Acetic Acid) dan ekstrak tauge selama periode pembibitan. Jurnal Ilmiah Wahana Pendidikan, 2022; 8(10), 64-72.DOI: https: //doi.org/10.5281/zenodo.6791669

[29]. Shaban, M. Study on some aspects of seed viability and vigor. International Journal of Advanced Biological and Biomedical Research, 2013; 1(12): 1692-1697

[30]. Fitriesa, S., Sari, M., dan Suhartanto, M.R. Pengaruh pemupukan N, P, dan K pada dua varietas benih kedelai (*Glycine Max* (L) Merr.) terhadap kandungan antosianin dan hubungannya dengan vigor benih. Buletin Agrohorti, 2017; 5 (1),117 – 125.

[31]. Prawiranata , W., Harran, S., dan Tjondronegoro, P. D. Fisiologi Tumbuhan. 1981; Departemen Botani, Faperta IPB. Bogor.

[32]. Ruliyansyah, A.Peningkatan Performansi benih kacangan dengan perlakuan invigorasi. Jurnal Teknologi Perkebunan & PSDL 2011; 1(-),13-18.