INT. J. BIOL. BIOTECH., 12 (2): 215-222, 2015.

COMBINED EFFECT OF INORGANIC FERTILIZERS AND PLANT EXTRACTS ON GROWTH AND IN THE CONTROL OF ROOT ROT FUNGI OF CROP PLANTS

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ABSTRACT

Recent research work was conducted to observe the efficacy of inorganic fertilizers with extracts of *Aerva javanica* parts on the growth and in the control of root rot fungi (*Macrophomina phaseolina* (Tassi) Goid, *Rhizoctonia solani* (Kühn) and *Fusarium* spp.) on cowpea and mungbean. Seeds of cowpea and mung bean were treated with *A. javanica* parts extracts and soil was amended with inorganic fertilizers such as Urea and DAP (Diamonium phosphate) @ 0.001, 0.01 and 0.1%. Infection of root rot fungi were completely suppressed when seeds of both leguminous crops treated with *A. javanica* leaves extract and soil amended with inorganic fertilizers @ 0.001, 0.01 and 0.1% as well as maximum enhancement in plant growth parameters was observed when Urea used @0.01 and 0.1%.

Key-words: inorganic fertilizers, plant extracts, root rot fungi, cowpea, mungbean.

INTRODUCTION

The most important elements present in inorganic fertilizers are nitrogen, phosphorus, and potassium which influence vegetative and reproductive phase of plant growth. Combination of organic and inorganic sources of nutrients might be helpful to obtain a good economic return with good soil health for the subsequent crop yield (Deshmukh *et al*., 2010). Fertilizers are generally applied to improve the crop yield, nutritional quality and aesthetic value of crops (Huber and Watson, 1970). Compared to inorganic fertilizers the organic fertilizer having lowered the nutrient content, solubility, and nutrient release rates than inorganic fertilizers and therefore inorganic fertilizers are more preferred than organic fertilizers. Besides this application of organic manures not only produced the highest and sustainable crop yield, but also improved the soil fertility and productivity of land (Sanwal *et al*., 2007).

The fertilizers not only having direct physiological effects on the plant growth but also affect the microbial activity of the pathogens and associated soil microflora (Curl and Rodriguez-kabana, 1973). Fertilizers play an important role in the control of soil borne root rot diseases of crop plants. Different fertilizers are used for better plant growth. Major portion of applied Phosphorus (P) is converted to form not available to plants and it is attributed to high P fixing capacity, high pH and activity of $CaCO_3$. Therefore, in view of low soil fertility status, nutrient management based on utilization of various resources viz., soil, organic, biological and mineral fertilizer with particular references to arid conditions is necessary, not only in sustaining productivity and soil health but also in meeting fertilizer requirement of different crops (Hedge and Dwived, 1993). The synergistic use of organic and mineral fertilizers increase each other's efficacy (Hussain *et al*., 1992).

Babu *et al.,* (2008) reported that plant extract and their compounds control fungal pathogen. Plant extract significantly inhibited the radial growth of isolated fungus. Plant extract can be successfully devised as fungicides using a simple process with few chemical agents. So plant extract may be considered suitable for seed and foliar treatment. Amongst the plant extracts used *Azadirachta indica* was found the most effective at 20% concentration followed by *Rheum emodi*, *Eucalyptus globulus*, *Artemessia annua* and *Ocimum sanctum* (Russel and Mussa, 1977) and *Prosopis juliflora* (Raghavendra *et al*., 2002). Datar (1999) reported that antifungal property of *Polyalthia longifolia* extracts against *Macrophomina phaseolina.* Youssef (1997) stated that application of natural seeds in *Aloe Vera* extract at 50 and 100% concentrations increased fresh and dry weights of leaves and number of florets per spike of *Delphinium ajacis* and flower head of *Callisteephus chinensis*.

Dong *et al*. (2004) concluded that the aqueous leaf extract of *Aloe Vera* as a natural plant growth regulator. Pathak and Srivastava (2000) stated that the total phenols content in sunflower was maximum after treatment with *Lowsonia inermis*. Singh *et al.,* (2006) revealed that the extract of *Lowsonia inermis* gave significantly superior control of white fly in tomato over the untreated check. Helmy (1992) observed that soil drenching with garlic extract gave the best results in increasing the number of flowers. *Allium sativum* extract showed comparatively greater efficacy in promoting the growth of *Arachis hypogea* (Sayeeda and Ahmad, 2005).

A. javanica extracts showed strong antiseptic activity against *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus, Salmonella typhi*, and *Staphylococcus epidermidis* and antifungal activity against *Aspergillus flavus, A. fumigatus* and *Fusarium solani* (Mufti *et al*., 2012). Srinivas and Reddy (2012) revealed that

Aerva javanica leaf and flower extracts contain rutin and kaempferol which demonstrated strong antibacterial activity against a number of bacteria and it can be used against bacterial disease (Reedy and Reedy, 2009). Sharif *et al*., (2011) isolated isoquercetin, apigenin and kaempferol from *Aerva javanica*, showed strong antimicrobial action.

Root rot caused by *F. oxysporum* is one of the most prevalent soil borne diseases. This disease causes significant losses and occurs in both greenhouse and field condition (Hartman and Fletcher, 1991). Similarly, *Macrophomina phaseolina* produces charcoal rot of over 500 species of plants (Sinclair, 1982) where at least 72 hosts have been reported from Pakistan (Mirza and Qureshi, 1978). *Rhizoctonia solani* is a necrotropic soil borne pathogen with high competitive saprophytic activity (Garett, 1970). *R. solani* is one of the causal agents of diseases associated with roots and tubers of different crops, causing significant yield losses (Carling *et al*., 1989). Present studies have been conducted to investigate the combine effect of fertilizers and seed treatment with aqueous extract of *Aerva javanica* on plant growth and in the control of root rot diseases.

MATERIALS AND METHODS

Collection of plant material:

Healthy non infected leaves, stem and flowers of *Aerva javanica* (Burm.f.) Juss. Ex Schult were collected from the campus of University of Karachi. All plant parts were washed with distilled water to remove dust. After drying they were powdered by using an electric grinder.

Preparation of plant extract:

Ten g of the plant parts powder was added in water in the ratio of 1:2 (weight by volume). It was strained through muslin cloth. The extract was allowed to settle for a while and the supernatant was passed through Whatman's filter paper No.41 in to 50 ml Pyrex flask. The filtrate was used for the test. The concentration of the extract thus prepared was used as stock solution (100%). This stock solution was diluted by sterilized distilled water to prepare 50 and 25% concentrations.

Physical properties of soil:

The sandy loam soil contains 70% sand, 11% silt and 10% clay, and has a pH of 9.6 with 49% water-holding capacity (Keen and Raczkowski, 1922), 0.077–0.099% of total nitrogen (Mackenzie and Wallace, 1954). 5 sclerotia/g of *M. phaseolina* was isolated using the sieving technique (Sheikh and Ghaffar, 1975); 5–20% of *R. solani* on sorghum seeds was used as baits (Wilhelm, 1955) and *Fusarium* spp. 2000 $cfug^{-1}$ was assessed by soil dilution technique (Nash and Snyder 1962).

Seed treatment with plant extract:

Seeds of cowpea and mungbean were surface sterilized with 1% $Ca(OCl)_2$ air dried and soaked in 100, 50 and 25% extracts for 10 minutes then air dried on blotter paper.

Experimental set up in green house:

Plastic pots filled with 300g soil and inorganic fertilizers such as urea and DAP (Diamonium phosphate) at 0.001, 0.01 and 0.1% w/w was amended in soil. Five seeds treated as above were sown in each pot and watered regularly to maintain sufficient moisture. The pots were kept in screen house in randomized complete block design with three replicates per treatment. Seeds treated with sterilized distilled water served as control. Growth parameters like shoot and root length their weight, leaf area and number of nodules were recorded after 30 days of seed germination. Infection of root colonization fungi were recorded from each root segment of test crop plants.

Data analysis:

Data were subjected to analysis of variance (ANOVA) followed by the least significant difference (LSD) test at $P = 0.05$, according to Gomez and Gomez (1984).

RESULTS

Soil amended with inorganic fertilizers and seeds of cowpea were treated with *A. javanica* leaves extract showed maximum enhancement in germination percentage ($P<0.001$) in comparison with control and in alone application of fertilizers and *A. javanica* parts extracts. Length and fresh weight of shoot and root were significantly ($P<0.001$) increased when DAP mixed in soil @ 0.001 % w/w and seeds of cowpea were treated with *A. javanica* leaves extract. Root length significantly ($P<0.05$) increased when seeds were treated with *A. javanica* leaves extract @

100% and urea mixed in soil @ 0.001%. Leaves extract of *A. javanica* in combination with urea @0.001% showed significant (P<0.001) enhancement in leaf area and number of nodules. Complete reduction in the colonization percentage of root rot fungi viz., *Fusarium* spp., *R. solani* and *M. phaseolina* was observed when seeds were treated with *A. javanica* leaves extract and soil was amended with inorganic fertilizers. 100 % germination of mung bean plants were observed when inorganic fertilizers such as urea and DAP used with *A. javanica* parts extract followed by control. Shoot length significantly increased (P<0.001) when DAP used @0.01% and seeds of mung bean were treated with *A. javanica* leaves extract. Length and fresh weight of roots, leaf area and number of nodules were significantly (P<0.001) increased when urea and DAP mixed in soil @ 0.1 and 0.01% in combination with seeds treated with *A. javanica* leaves extract. Colonization percentage of root rot fungi such as *R. solani* and *M. phaseolina* was completely suppressed when seeds were treated with *A. javanica* leaves extract in combination with Urea and DAP, whereas colonization of *Fusarium* spp. was significantly (P<0.001) reduced when inorganic fertilizers incorporated in soil and seeds were treated with *A. javanica* leaves extract.

Table 1. Effect of seed treatment with *Aerva javanica* extracts in combination with inorganic fertilizers on the growth parameters of cowpea.

Treatments	Germination Percentage	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Root weight (g)	Leaf area (cm^2)	Number of nodules
Control	80±20	17.6±1.1	2.1±0.5	9.1±1.0	0.24±0.4	11.6±1.7	5±0.57
Urea @0.001%	100±0.0	23.3±4.1	2.6±0.3	14.6±1.5	0.52±0.0	18.9±1.8	12±5.7
Urea @0.01%	100±0.0	24.6±1.5	2.5±0.3	12.3±2.5	0.79±0.0	18.3±1.4	13±2.0
Urea @0.1%	100±0.0	23.6±2.0	2.9±0.1	11.4±3.1	0.60±0.2	19.1±3.6	11±2.0
DAP@0.001%	100±0.0	27.3±2.5	2.7±0.0	12.0±2.6	0.70±0.3	19.9±1.3	10±0.5
DAP@0.01%	100±0.0	26.4±3.3	2.6±0.0	15.0±2.2	0.32±0.0	19.9±2.4	13±5.7
DAP@0.1%	100±0.0	28.2±3.0	3.2±0.3	12.4±2.9	1.04±0.1	21.6±1.3	12±1.7
A. javanica stem	100±0.0	24.3±0.5	2.3±0.2	11.0±1.7	1.82±0.0	15.6±2.1	9.0±0.5
AS+ Urea @0.001%	100±0.0	28.6±2.0	2.9±0.9	15.0±3.6	0.84±0.0	22.0±2.0	16±8.9
AS + Urea @0.01%	100±0.0	30.3±0.5	2.9±0.1	15.3±4.5	0.66±0.1	19.0±1.7	14±1.5
AS + Urea @0.1%	100±0.0	28.3±2.0	2.8±0.2	11.3±3.2	1.32±0.2	18.5±1.2	17±5.0
AS +DAP@0.001%	100±0.0	30.3±0.5	2.6±0.1	16.0±4.5	0.96±0.2	20.2±0.9	12±3.2
AS +DAP@0.01%	100±0.0	29.3±0.5	3.6±0.5	15.0±5.0	0.89±0.0	22.2±2.2	20±9.5
AS +DAP@0.1%	100±0.0	30.6±0.5	3.0±0.6	13.0±1.7	1.17±0.0	22.8±3.8	20±0.5
A. javanica leaves	100±0.0	27.6±1.5	3.3±0.1	11.0±1.0	1.26±0.0	16.4±2.9	11±2.3
AL + Urea @0.001%	100±0.0	32.2±0.5	3.0±1.6	20.2±2.4	0.98±0.0	24.6±2.3	26±4.0
AL + Urea @0.01%	100±0.0	32.0±1.0	2.3±1.3	16.2±4.0	1.16±0.5	22.1±3.2	24±2.6
AL + Urea @0.1%	100±0.0	31.3±1.1	4.1±0.9	15.3±4.7	1.28±0.3	25.8±4.4	28±2.0
AL +DAP@0.001%	100±0.0	32.9±1.0	5.6±0.5	18.3±9.4	2.12±0.3	24.6±2.4	19±4.5
AL +DAP@0.01%	100±0.0	32.2±0.5	4.1±0.2	17.3±3.2	0.65±0.3	25.8±4.0	16±1.1
AL +DAP@0.1%	100±0.0	29.0±1.5	3.5±0.2	17.3±4.0	0.66±0.2	24.1±2.0	19±1.0
A. javanica flowers	100±0.0	29.3±1.0	2.4±0.3	11.6±3.7	0.80±0.0	12.8±1.8	8±6.4
AF + Urea @0.001%	100±0.0	29.6±0.5	2.9±0.2	11.0±1.0	0.97±0.4	22.0±3.0	15±2.0
AF + Urea @0.01%	100±0.0	30.6±0.5	3.2±0.8	12.0±1.7	0.76±0.0	21.6±2.5	13±2.6
AF + Urea @0.1%	100±0.0	29.3±1.1	3.1±0.2	12.8±2.0	0.76±0.0	18.9±1.4	12±4.0
AF +DAP@0.001%	100±0.0	27.3±0.5	3.2±0.1	13.3±1.5	1.07±0.0	21.1±3.5	15±1.7
AF +DAP@0.01%	100±0.0	29.3±2.6	3.1±0.2	12.2±2.6	1.15±0.1	21.3±1.9	13±3.2
AF +DAP@0.1%	100±0.0	30.0±0.5	3.0±0.0	12.5±0.5	1.25±0.1	21.5±2.5	14±3.0
$LSD_{0.05}$	9.59	2.98	0.90	5.62	0.50	4.25	6.52

AS = *Aerva javanica* stem extract; AL = *Aerva javanica* leaves extract; AF = *Aerva javanica* flower extract.

Table 2. Effect of seed treatment with *Aerva javanica* extracts in combination with inorganic fertilizers in the control of root rot fungi of cowpea.

Treatments	*Fusarium* spp.	*Rhizoctonia solani*	*Macrophomina phaseolina*
Control	100±0.0	100±0.0	100±0.00
Urea @0.001%	50.76±32.63	50.76±25.16	24.33±26.76
Urea @0.01%	24.00±3.46	24.22±13.87	28.88±7.69
Urea @0.1%	42.00±3.46	42.00±8.08	33.11±7.00
DAP@0.001%	26.66±11.54	26.66±17.64	24.22±20.00
DAP@0.01%	35.11±10.11	35.11±7.69	24.22±10.11
DAP@0.1%	44.11±9.97	44.11±8.08	17.77±3.85
A. javanica stem	11.10±3.85	0.00±0.00	11.10±3.85
AS+ Urea @0.001%	11.10±3.85	0.00±0.00	0.00±0.00
AS + Urea @0.01%	13.33±6.67	6.66±11.54	0.00±0.00
AS + Urea @0.1%	15.55±3.85	11.10±7.70	11.10±3.85
AS +DAP@0.001%	11.10±7.70	0.00±0.00	0.00±0.00
AS +DAP@0.01%	17.77±3.85	0.00±0.00	0.00±0.00
AS +DAP@0.1%	21.77±7.70	0.00±0.00	11.10±3.85
A. javanica leaves	26.44±3.85	17.77±3.85	11.10±0.00
AL + Urea @0.001%	0.00±0.00	0.00±0.00	0.00±0.00
AL + Urea @0.01%	0.00±0.00	0.00±0.00	0.00±0.00
AL + Urea @0.1%	0.00±0.00	0.00±0.00	6.66±0.00
AL +DAP@0.001%	0.00±0.00	0.00±0.00	0.00±0.00
AL +DAP@0.01%	0.00±0.00	0.00±0.00	0.00±0.00
AL +DAP@0.1%	4.44±13.34	0.00±0.00	0.00±6.67
A. javanica flowers	6.66±10.18	30.88±4.23	13.33±3.85
AF + Urea @0.001%	8.88±6.67	19.9±11.54	17.77±3.84
AF + Urea @0.01%	19.77±6.33	37.5±11.54	2.22±3.44
AF + Urea @0.1%	24.44±7.69	19.99±0.00	4.44±0.00
AF +DAP@0.001%	19.99±13.33	6.66±10.18	0.00±3.85
AF +DAP@0.01%	28.44±7.31	11.11±0.00	2.22±3.84
AF +DAP@0.1%	22.00±3.46	6.66±0.00	11.10±0.00
$LSD_{0.05}$	16.32	13.07	12.43

DISCUSSION

Seed treatment with *Aerva javanica* extracts and soil amendment with inorganic fertilizers showed maximum enhancement in plant growth parameters. Ukal *et al.,* (2013) reported that application of inorganic fertilizers in soil enhanced the growth of plant height, fresh weight, leaf area and dry weight. Toxicity of ammonia ion released during degradation of urea exerted an adverse effect on soil borne pathogens (Oteifa, 1955). Pal and Choudhary (1980) also found that root rot disease caused by *F. oxysporum* and *R. solani* reduced by the addition of mineral fertilizers.

Infection of *M. phaseolina* and *R. solani* were completely suppressed when *A. javanica* leaves treated seeds used with inorganic fertilizers similarly, Siddiqui *et al.,* (1999) also reported that root rot diseases in mung bean caused by *Fusarium* spp., *M. phaseolina* and *R. solani* also reduced by the addition of urea and potash. Potassium is also known to reduce *Fusarium oxysporum* infection on tomato (Ellet, 1973) and *Rhizoctonia solani* infection on hemp (Pal and Choudhary, 1980). Dawar and Ghaffar (2003) reported that urea showed significant reduction in *M. phaseolina* infection on mung bean. Maximum shoot length and shoot weight were observed on okra when frutan and urea were used @ 0.1% w/w in combination with pneumatophore and leaves powder whereas urea used @ 0.1% w/w in combination with leaves on mung bean plants (Tariq *et al*., 2008). Irshad *et al*., (2006) observed that infection of *Rhizoctonia solani* was completely inhibited when frutan applied in soil @ 0.1% among different dosages of widely used locally available inorganic fertilizers viz., flourish, frutan, NPK, urea and fishmeal.

Table 3. Effect of seed treatment with *Aerva javanica* extracts in combination with inorganic fertilizers on the growth parameters of mung bean.

Treatments	Germination percentage	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Root weight (g)	Leaf area (cm^2)	Number of nodules
Control	56±5.7	11.6±0.5	1.06±0.1	5.0±1.0	0.25±0.0	3.44±0.5	2±0.5
Urea @0.001%	73±11.5	18.6±0.5	1.71±0.2	9.6±2.5	0.28±0.0	8.50±1.6	7±1.5
Urea @0.01%	80±0.0	18.3±1.1	1.53±0.3	11±1.0	0.37±0.0	8.30±1.2	9±0.5
Urea @0.1%	80±0.0	20.3±2.5	1.82±0.3	12±1.7	0.29±0.0	8.46±1.7	7±0.5
DAP@0.001%	100±0.0	19.0±2.0	1.78±0.6	12±3.0	0.45±0.1	7.71±0.4	10±0.0
DAP@0.01%	100±0.0	19.3±1.5	2.03±0.2	13±2.6	0.36±0.1	8.93±0.4	11±0.5
DAP@0.1%	100±0.0	21.3±2.0	2.57±0.4	12±7.0	0.27±0.0	8.50±0.9	12±2.0
A. javanica stem	100±0.0	20.0±1.0	1.62±0.2	9.1±2.0	0.54±0.0	8.80±0.5	10±2.0
AS+ Urea @0.001%	100±0.0	25.0±1.0	2.47±0.2	15±3.6	0.73±0.1	11.5±0.8	11±1.7
AS + Urea @0.01%	100±0.0	26.3±0.5	2.75±0.2	14±4.3	0.56±0.1	11.1±0.5	13±1.1
AS + Urea @0.1%	100±0.0	25.6±1.1	2.74±0.0	18±3.2	0.78±0.3	12.1±1.7	12±3.7
AS +DAP@0.001%	100±0.0	24.6±1.5	2.67±0.1	14±2.5	0.55±0.0	11.2±0.7	9.0±1.0
AS +DAP@0.01%	100±0.0	28.0±1.0	2.86±0.0	12±1.7	0.52±0.0	11.5±0.2	12±1.1
AS +DAP@0.1%	100±0.0	21.3±3.2	2.91±0.0	14±1.7	0.60±0.0	14.5±2.1	15±3.2
A. javanica leaves	100±0.0	20.6±0.5	1.91±0.0	7.6±1.1	0.47±0.1	9.71±1.9	11±1.1
AL + Urea @0.001%	100±0.0	28.0±1.0	2.81±0.0	12±2.0	1.41±0.4	26.4±3.5	22±3.2
AL + Urea @0.01%	100±0.0	27.3±1.5	3.71±0.4	19±4.3	0.78±0.2	11.8±0.1	13±2.6
AL + Urea @0.1%	100±0.0	28.6±1.5	2.87±0.1	10±2.0	0.35±0.0	11.7±0.8	12±7.9
AL +DAP@0.001%	100±0.0	27.0±1.0	2.86±0.0	10±1.0	0.57±0.0	13.2±2.4	16±1.1
AL +DAP@0.01%	100±0.0	29.0±1.0	2.83±0.0	13±3.2	0.62±0.0	7.33±1.3	20±5.5
AL +DAP@0.1%	100±0.0	19.6±0.5	2.65±0.1	15±3.0	0.75±0.2	11.1±1.5	12±1.1
A. javanica flowers	100±0.0	26.3±1.5	2.23±0.0	8.5±2.0	0.31±0.1	13.3±0.6	9.0±2.5
AF + Urea @0.001%	100±0.0	26.3±0.5	2.66±0.3	10±1.5	0.36±0.0	13.2±0.7	11±1.0
AF + Urea @0.01%	100±0.0	23.6±1.1	2.77±0.1	12±4.5	0.29±0.0	10.6±1.8	12±4.3
AF + Urea @0.1%	100±0.0	25.0±1.0	2.43±0.1	12±2.5	0.30±0.0	13.4±3.2	9±0.5
AF +DAP@0.001%	100±0.0	24.6±1.5	2.59±0.0	14±3.4	0.29±0.0	11.7±0.2	11±1.0
AF +DAP@0.01%	100±0.0	25.6±1.0	2.81±0.1	10±1.5	0.30±0.0	10.1±2.4	11±1.5
AF +DAP@0.1%	100±0.0	25.0±0.5	2.76±0.0	15±4.3	0.31±0.0	11.5±0.9	9.0±1.1
$LSD_{0.05}$	5.31	2.26	0.39	5.25	0.26	2.56	4.21

Parveen *et al.,* (2008) recorded that urea and potash separately and in combination significantly reduced the *M. phaseolina* infection. Marschner (1995) observed that high nitrogen level have been reported to increase the root exudation which stimulates higher population of *Pseudomonas aeruginosa* and *Rhizobium* around root. Significant reduction in colonization of *M. phaseolina* was observed when soil was amended with urea and DAP and seeds were treated with *R. meliloti*. Anis *et al.,* (2013) observed that colonization of *M. phaseolina* was completely inhibited when soil was treated with urea, DAP, potassium sulphate, ammonium nitrate and urea in combination with *Trichoderma viride* and ammonium nitrate in combination with *R. meliloti*. Attarde *et al*., (2012) observed that addition of organic and inorganic fertilizers in soil showed greatest plant height, leaf area and fresh weight of okra. Akanbi *et al*., (2010) reported that inorganic fertilizers can improve crop yields and soil pH, total nutrient content, and nutrient availability on the growth of okra. Adewole and Ilesanmi (2012) reported that inorganic fertilizers like NPK in soil degradation resulting from loss of inorganic matter which leads to higher acidity, nutrient imbalance and low crop yield. On the other hand, organic manures promote microbial degradation and the gradual release of nutrients.

Table 4. Effect of seed treatment with *Aerva javanica* extracts in combination with inorganic fertilizers in the control of root rot fungi of mung bean.

Treatments	*Fusarium* spp.	*Rhizoctonia solani*	*Macrophomina phaseolina*
Control	100±0.00	100±0.00	100±0.00
Urea @0.001%	20.0±0.00	24.4±7.69	24.0±3.46
Urea @0.01%	17.7±3.85	15.5±7.70	26.4±6.67
Urea @0.1%	22.0±20.2	21.9±21.0	17.5±7.31
DAP@0.001%	22.2±15.3	22.0±3.46	22.2±16.7
DAP@0.01%	24.4±7.69	22.2±16.7	19.7±6.33
DAP@0.1%	22.2±10.1	13.3±6.67	0.00±0.00
A. javanica stem	19.7±6.33	8.88±3.85	4.44±3.84
AS+ Urea @0.001%	11.1±3.85	11.1±7.70	6.66±0.00
AS + Urea @0.01%	17.7±3.85	8.88±3.85	20.0±0.00
AS + Urea @0.1%	17.5±9.89	13.3±6.67	4.44±3.84
AS +DAP@0.001%	15.5±7.70	8.88±3.85	0.00±0.00
AS +DAP@0.01%	13.1±13.0	15.5±16.7	8.88±3.85
AS +DAP@0.1%	17.7±3.85	2.22±3.84	13.1±13.0
A. javanica leaves	13.3±0.00	0.00±0.00	4.44±3.84
AL + Urea @0.001%	4.44±3.84	0.00±0.00	0.00±0.00
AL + Urea @0.01%	6.66±0.00	0.00±0.00	0.00±0.00
AL + Urea @0.1%	6.66±0.00	0.00±0.00	0.00±0.00
AL +DAP@0.001%	2.22±3.84	0.00±0.00	0.00±0.00
AL +DAP@0.01%	0.00±0.00	0.00±0.00	0.00±0.00
AL +DAP@0.1%	6.66±6.66	24.2±10.1	0.00±0.00
A. javanica flowers	11.0±7.70	15.3±11.5	30.7±20.2
AF + Urea @0.001%	22.2±10.1	15.3±9.82	11.0±3.85
AF + Urea @0.01%	28.4±4.23	19.7±6.33	17.7±13.8
AF + Urea @0.1%	22.0±3.46	4.44±3.84	22.2±10.1
AF +DAP@0.001%	28.6±10.2	22.0±6.67	21.7±7.31
AF +DAP@0.01%	6.66±6.66	0.00±0.00	8.88±3.85
AF +DAP@0.1%	13.3±6.67	0.00±0.00	28.4±4.23
$LSD_{0.05}$	12.38	13.80	11.71

Maximum weight of crop plants were observed when fertilizers incorporated in soil because nitrogen present in the fertilizer is absorbed by the plant which is utilized in protein synthesis and seed production whereas potassium is involved in many cellular functions including photosynthesis, phosphorylation, water maintenance, reduction of nitrates and reproduction. Potassium is also known to reduce *F. oxysporum* infection on tomato (Ellet, 1973) and *R. solani* infection on hemp (Pal and Choudhary, 1980). Urea also inhibits soil borne root-infecting fungi on mung bean (Dawar and Ghaffar, 2003). Tariq *et al.*, (2008) studied that urea and frutan @ 0.1% in combination with leaves powder and pneumatophore of *Avicennia marina* increased plant growth parameters and completely suppress the infection of *M. phaseolina* when urea and DAP were used @ 0.01 and 0.1% w/w with *A. marina* leaves powder on okra. In pea field the application of nitrogen plus phosphorus, phosphorus plus potassium or nitrogen plus phosphorus plus potassium were effective in reducing severity of root rot caused by *R. solani* and *F. oxysporum* (Srihuttagum and Sivasitham, 1991).

Seed treatment with plant extracts and soil amendment with inorganic fertilizers showed enhancement in fresh weight of plants and showed complete reduction in *R. solani* and *M. phaseolina* infection on test crop plants.

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(*Accepted for publication March 2015*)