Research Article

Evaluation of Compost with different NPK level on pea plant under drought stress

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Abstract

Drought stress is one of the big issues, responsible for reducing crop production in the world. One of the strategies to increase crop yield is use of organic and inorganic fertilizers. The compost and NPK has positive role under drought stress on plant growth. For this purpose, the seeds of two varieties, Barani variety and Hybrid F1 variety of pea plant were purchased from local market, Rawalpindi. The compost and NPK were also purchased from local market, Rawalpindi. In order to study the effect of compost and NPK on pea plant were carried out in Green House of PMAS Arid Agriculture University, Rawalpindi. The combined effect of compost and NPK had showed significant increase in root length of Barani variety 70% and Hybrid variety 50%, shoot length of Barani variety 59% and Hybrid variety 70%, soil moisture of Barani variety 33% and Hybrid variety 37%, relative water content of Barani variety 48% and Hybrid variety 45%, chlorophyll a of Barani variety 70% and Hybrid variety 33%, chlorophyll b of Barani variety 43% and Hybrid variety 18% and total chlorophyll content of Barani variety is 51% and Hybrid variety 22% under the drought stress as compared to the drought control.

Keyword: Pea; Compost; Drought; Fertilizer

Introduction

Pea (*Pisum sativum*) is a cool season food legume, has a wide variety of uses. It is the second most important legume in the world for its use [1] and is grown in different regions of the world. It is commonly used in the form of dry pulses, fresh peas and edible podded type [2]. It has been economically grown for the canning industry and traditionally for dry grain [3]. Peas are

grown particularly on all types of soil from light sandy to heavy clay. Frequent irrigation tends to increase vegetative growth at the expense of pod formation [4]. The high yield of plant in adequate irrigated conditions is not necessarily correlated to high yield under drought stress [5]. Depending on which stage of growth a plant experiences drought stress, it reacts in a different way to the stress [6]. A local undesirable effect of water stress on crop

plants is reduction of fresh and dry biomass production [7]. Plant productivity under drought stress is strongly linked to the processes of dry matter partition and temporal biomass division [8]. Plant may be affected by drought at any time of life, but certain stage such as germination and seedling growth are critical [9]. Organic agriculture is one of the ways that can produce high quality crops [10]. Compost and NPK play a vital role to increase the growth in pea plant [11]. The experiment had been conducted to determine the effect of Compost and NPK on pea plant under drought stress.

Materials and Methods

The present study was carried out to check the effect of Compost and NPK on growth and yield of pea under well-water condition and drought stress (Table-1). Two pea varieties i.e. Barani variety and Hybrid F1 variety were collected from Local Market, Rawalpindi. The compost and NPK were also brought from Local Market, Rawalpindi. Pot experiment was conducted in Green House at Research Area, Department of Botany, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi. Compost was added in soil 1:3 ratio and 0.22g of NPK was added in soil per pot. Seeds of both varieties were surface sterilized in 0.1 % mercuric chloride solution for 5 minutes and several times with distilled water. In each earthen pot eight sterilized seeds of Barani variety were sown and were thinned to three after germination. After 40 days of seedlings, the plants of both varieties were imposed to drought stress for 7 days by withholding water.

Soil analysis:

Gravimetric method [12] was used to for moisture content estimation. Fresh weight of soil was obtained and soil dried in oven at 105°C for three days or until constant weight. Dry weight was later on measured

and moisture content of soil was calculated in percentage by following formula:

$$\text{Soil Moisture \%} = \frac{\text{Wet soil (g)} - \text{Dry soil (g)}}{\text{Dry soil (g)}} \times 100$$

Plant analysis:

Plant analysis for each treatment were collected and analyzed for different morphological and physiological parameters.

Morphological Parameter:

For each treatment, two plants were uprooted and separated into root and shoot. After washing root and shoot, Root length (cm) and shoot length (cm) were measured for each treatment at the end of experiment. For each treatment, plants were uprooted, washed afterward and determined the fresh weights of root and shoot. Dry weight of root and shoot was recorded by placing same samples of root and shoot in oven at 65°C for each treatment. Fresh and Dry weight of root and shoot were taken in grams (g).

Physiological parameter:

For each treatment fresh weight of flag leaf was recorded. Same leaves were soaked in water for 24 hours and their turgid weights were obtained. Afterward measuring the weight leaf samples were placed at 70°C in oven for 72 hours and dry weight was recorded. Following formula was used:

$$\text{RWC} = \frac{(\text{Fresh weight} - \text{Dry weight})}{(\text{Saturated weight} - \text{Dry weight})} \times 100$$

Method of [13] was used for evaluation of total chlorophyll contents 0.2 g leaf was homogenized in known volume of acetone (10 ml). Filtrate was taken in another set of tubes. Absorbance of extract was recorded at 645, 652 and 663 nm. By using following equations chlorophyll contents were estimated:

$$\text{Total Chlorophyll content} = (A_{652} \times 1000/34.5)$$

$$\text{Chlorophyll a content} = 12.7 (A_{663}) - 2.7 (A_{645})$$

$$\text{Chlorophyll b content} = 22.9 (A_{645}) - 4.7 (A_{663})$$

Results and Discussion

Compost and NPK had significant role on growth parameters of both varieties of pea plant (*Pisum sativum*). Compost had increased root of barani variety about 58% and Hybrid variety about 50% as compared to drought control. NPK had increased root of barani variety is 77% and Hybrid variety is 46%. The combined effect of compost and NPK had increased root length of Barani variety is 70% and Hybrid variety is 50% as compared to control under drought as shown in fig.1.

A significant effect of compost and NPK has been observed on shoot length. As the shoot length of barani variety had increased due to compost is 50% and Hybrid variety is 77% as compared to the control under drought. NPK had increased shoot of barani variety is 80% and Hybrid variety is 77%. The combined effect of compost and NPK had increased root length of Barani variety is 59% and Hybrid variety is 70% as compared to control under drought as shown in fig.2. Chuan et al., [14] had checked the effect of vermi-compost and NPK on pea plant, comprised seven treatment consisting of three treatments with compost and three treatments with vermin-compost + NPK and one treatment is FYM + NPK. The treatment (vermin-compost + NPK) had showed a positive result on pea plant to increased plant height and pod weight. The pea plant with the application of compost and NPK also comprised best growth under drought stress and had increased root length and shoot length. The compost and NPK has increased the soil moisture of soil under the drought stress. Compost had increased soil moisture of barani variety about 33% and Hybrid variety about 46% as compared to drought control. NPK had increased soil

moisture of barani variety is 57% and Hybrid variety is 50%. The combined effect of compost and NPK had increased root length of Barani variety is 33% and Hybrid variety is 37% as compared to control under drought as shown in fig.3.

Compost and NPK had played a vital role to increase the relative water content of pea varieties under drought stress. Compost had increased relative water content of Barani variety about 71% and Hybrid variety about 60% as compared to drought control. NPK had increased soil moisture of barani variety is 71% and Hybrid variety is 66%. The combined effect of compost and NPK had increased relative water content of Barani variety is 48% and Hybrid variety is 45% as compared to control under drought as shown in fig.4. Sarwar ei al., [15] had reported that compost with and without inorganic fertilizer has significant role to increase the biomass of wheat and rice and also improved soil fertility. The similar effect had been found on pea plant. The compost and NPK had raised the crop production and responsible for improving the soil fertility by increasing soil moisture and relative water content. The chlorophyll a, chlorophyll b and total chlorophyll content are reduced under drought stress. Compost and NPK are responsible for increasing the chlorophyll a, chlorophyll b and total chlorophyll content of both varieties of pea plant under drought stress Compost had increased Chlorophyll a of Barani variety about 46% and Hybrid variety about 37% as compared to drought control. NPK had increased chlorophyll a of barani variety is 70% and Hybrid variety is 36.76%. The combined effect of compost and NPK had increased chlorophyll a of Barani variety is 70% and Hybrid variety is

Table-1. Experiment Layout

Label	Treatments
T ₀	Control $\pm$ well-water condition
T ₁	Control $\pm$ drought stress
T ₂	Compost $\pm$ well-water condition
T ₃	Compost $\pm$ drought stress
T ₄	NPK $\pm$ well water condition
T ₅	NPK $\pm$ drought stress
T ₆	Compost and NPK $\pm$ well water condition
T ₇	Compost and NPK $\pm$ drought stress

Fig.1. Effect of compost and NPK on root length (cm) of two pea varieties under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

Fig.2. Effect of compost and NPK on shoot length of two pea varieties under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

Fig.3. Effect of compost and NPK on soil moisture (%) of soil under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

Fig.4. Effect of compost and NPK on relative water (%) content of two pea varieties under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

Fig.5. Effect of compost and NPK on chlorophyll a of plant material of two pea varieties under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

Fig.6. Effect of compost and NPK on chlorophyll b of two pea varieties under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

Fig.7. Effect of compost and NPK on total chlorophyll content of two pea varieties under drought stress

Where T₀ = Control $\pm$ well-water condition, T₁ = Control $\pm$ drought stress, T₂ = Compost $\pm$ well-water condition, T₃ = Compost $\pm$ drought stress, T₄ = NPK $\pm$ well-water condition, T₅ = NPK $\pm$ drought stress, T₆ = Compost and NPK $\pm$ well-water condition, T₇ = Compost and NPK $\pm$ drought stress. And V₁ = Barani variety, V₂ = Hybrid F1 variety

33% as compared to control under drought as shown in fig.5.

Compost had increased Chlorophyll b of Barani variety about 29% and Hybrid variety about 40% as compared to drought control. NPK had increased chlorophyll b of barani variety is 46% and Hybrid variety is 19%. The combined effect of compost and NPK had increased chlorophyll b of Barani variety is 43% and Hybrid variety is 18% as compared to control under drought as shown in fig.6. Compost had increased total chlorophyll content of Barani variety about 35% and Hybrid variety about 24% as compared to drought control. NPK had increased total chlorophyll content of Barani variety is 52% and Hybrid variety is 22%. The combined effect of compost and NPK had increased total chlorophyll content of Barani variety is 51% and Hybrid variety is 22% as compared to control under drought as shown in fig.7. These results are in agreements with previous reports [7, 9-15].

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