Vegetables & Floriculture Department

Optimization of Cowpea Growing under Natural Soil Salinity and Use of Some Treatments to Alleviate the Harmful Effects of Salinity

BY

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5. English Summary and CONCLUSION

Optimization of Cowpea Growing under Natural Soil Salinity and Use of Some Treatments to Alleviate the Harmful Effects of Salinity

Salinity is one of the most threathen factor for crop production around world, in special, Egypt. Therefore, numerous researchers have focused on how ameliorate salinity stress and optimize the yield production. Using the approach by soil amendments and biostimulant for reducing the dangers of salinity and optimizing cowpea yield under natural soil salinity especially in agricultural Governorate; Damietta, is the main purpose in the current study. Therefore, two area, different levels in natural soil salinity between medium and high level at $5dSm^{-1}$ and $7dSm^{-1}$, respectively were chosen for this aim in El-Serw region where suffered from natural soil salinity.

The descriptive analysis of soil at both study sites confirmed that heavy clay soil is the main soil type related to an increasing in the percentage of clay and silt with decreasing in the percentage of sand in soil. In addition, the electric conductivity was higher at second area with $7dsm^{-1}$ related to increasing the concentration of different cations as sodium, calcium, and magnesium and anions as chloride, bicarbonates, and sulphates. The major cation present in saline soil was sodium, while the chloride content was the highest anion in soil solution.

Therefore, the experiment was began with seed priming for activation of seed embryo for more germination and making them more resistance for salinity stress. Seed priming designed under different levels of salinity as zero level, $5dSm^{-1}$ and $7dSm^{-1}$ in related to different soaking the

seeds applications i.e., without any treatment, Silicon (200ppm), yeast extract (50ml /L), and chitosan (200 ppm) under effect of salinity levels and foliar applications.

Obtained data clarified that salinity had a negetative effect in decreasing all indices of germinative and vegetative characteristics seed priming and the more indices was matched with zero salinity indices in opposite to higher level of salinity at $7dsm^{-1}$. Additionally, chitosan or yeast extract had more activation for seed priming in comparing with no treatment. Meanwhile, the successful interaction between salinity levels in relating to foliar applications was significantly prevailed that zero salinity treated with chitosan represented the more and fast germination indices with longer and heavy radicle and plumule. Oppositely, the higher level of salinity at $7dsm^{-1}$ without any treatment was the worst one in indices of seed priming.

In field, the design of experiment was carried out by spilt-spilt plot design into completely randomized blocks design with three replicates at two levels of salinity; $5dsm^{-1}$ and $7dsm^{-1}$. Both different levels of natural soil salinity as the main plots in combination with three different soil amendments; control (without any treatments), sulfuric acid (10L./fed.), sulphur (0.4 tan/ fed.), which were randomly distributed in the sub-plots and four different foliar applications; without treatment, silicon (200ppm), yeast extract (50ml /L), and chitosan (200ppm), were also randomly arranged in the sub-sub-plots. Twenty-four treatments were the net current study. This current study was carried out throughout two successive of cultivated seasons.

Vegetative, biochemical characteristics, yield productivity and seed quality were the chosen parameters for representing the quality of different

treatments in optimizing the cowpea yield and quality. The main results were statistically analyzed and could be summarized into the following points:

A. Vegetative traits

Vegetative characteristics of root and shoot were expressed by the length of both and the number of shoot branches, while on leaves, the number of leaves and area of leaf are the main vegetative parameters. Also, the weight of plant was expressed by the fresh and dry weight of plant. All data per both seasons was statistically analyzed for clarifying the effect of the following:

1. Effect of salinity

Salinity had an extremely significant effect on all aforementioned characters of vegetative characteristics. The most tallest and heaviest fresh and dry weight of root and shoot with increasing the number of branches and leaves and area of leaf was attributed to lower level of salinity stress at 5 dsm^{-1}. It was clarified during both growing seasons.

2. Effect of soil amendments

The representive data clarified the importance of soil amendments for improving the vegetative characteristics of cowpea. Which, sulphur had higher improvement in all vegetative traits then followed by sulfuric acid, where the least one was untreated plants in control plot.

3. Effect of foliar applications

a significant effect was detected in the effect of different foliar applications in increasing all vegetative traits during both growing seasons. The major improveable treatment was attributed to chitosan or with yeast extract followed with silicon. In contrast, the untreated plants at control plot was the poor vegetative traits during both seasons.

4. Effect of the interactions

The summarized results of the effect of different interactions were significant improved to different vegetative traits in treated plants in comparing with untreated ones at control plot during both growing seasons.

The best interacted results was lower level of soil salinity at 5dsm^{-1} combined with sulfur or sulfuric acid (different levels of natural soil salinity× different soil amendments) with chitosan or by yeast extract > Silicon by different levels of natural soil salinity× different foliar applications.

The matching between sulfur or sulfuric acid as soil amendment with chitosan or by yeast extract as foliar application were the most significant improved effect on those prementioned characteristics over both growing seasons. Meanwhile, non treatment was the worst one.

The most efficient interaction was clearly detected at the interaction between lower salinity levels (5dSm,$^{-1}$ Area 1) that treated by sulfur amended with soil and sprayed plants with chitosan or yeast extract on the vegetative characteristics of leaves, over both growing seasons. Addition sulfur or sulfuric acid with yeast extract at the same level then sulfur amended with soil and sprayed plants with chitosan at high level of natural salinity (^{1}Area 2, 7dSm^{-1}).

B. Biochemical traits

Biochemical traits were pointed to the concentration of pigments (total chlorophyll and carotenoid), minerals (potassium, nitrogen and phosphrous) and proline in plant leaves. Data were statistically expressed in mean values and indicated that **:**

1. Effect of salinity

Analyzed data clarified that the lower level of natural soil salinity at 5dsm^{-1} was the more improved to prementioned biochemical traits as in

plant leaves except proline concentration with significant variation between both salinity levels.

2. Effect of soil amendments

Different applied soil amendments had a significant effect in biochemical contents in leaves during both growing seasons. The highest improvement of various minerals and photosynthetic pigments were achieved to amended sulfur with soil followed to sulfuric acid. Oppositely, the minimal concentration of formely constituents was at like untreated plants (control).

3. Effect of foliar applications

All foliar applications with chitosan or by yeast extract were recorded the highest increase in the chemical constituents followed by silicon, over all growing seasons. Meanwhile, the minimal chemical content was in the leaves of untreated plants at control plot

4. Effect of the interactions

The combined interaction between different soil salinity levels and different applied soil amendments had significant increased in all biochemical content in compared with untreated one at both different soil salinity levels except only reduced proline content in treated plants with sulfuric acid either in lower or higher level of natural soil salinity.

The best interaction of previous combination was attributed to lower level of salinity level (Area 1) that was treated by chitosan or by yeast extract > silicon at the same level of salinity on the concentration of formely minerals. In addition, the best interaction was the effect of sulfur amended with soil combined with chitosan or yeast extract sprayed plant, followed by sulfuric acid as soil amendment mixed with foliar chitosan > sulfur with yeast extract > sulfuric acid and yeast on improvement of various minerals

The major improved interaction for the formely minerals was the combined addition of sulfur in soil then sulfuric acid with spraying chitosan or with spraying yeast extract at lower level of salinity (Area 1), respectively. Followed to that, the more efficient interaction at high level of soil salinity was the combination of sulfur in soil and foliar chitosan, over all study seasons. Oppositely, the worst one for all interactions was higher level of soil salinity × without treatment at control.

C. Flowering and Yield traits

Different yield parameters i.e., the mean number of flowers and the percentage of fruit set. In addition to No. of pods, the length and weight of pods per plant, mean number of seeds per pod for calculate shelling ratio, weight of hundred seeds, and yield or mass yield were recorded for detection the effect of different factors in the current results as the following:

1.Effect of salinity

A significant increasing of yield parameters was corresponded with decreasing the salinity level. Where, the medium level of salinity at 5dsm^{-1} (area 1) had the highest number of flowers, pods with evelated percentage of fruit set as well as having be the tallest pods and heaviest weight of seeds with higher shelling ratio and yield in comparing to the same counterpart of yield parameters at high level of salinity at 7dsm^{-1} .

2. Effect of soil amendments

Different applied soil amendments had significant effect on all yield parameters as well as had an improved role in increasing the yield parameters in treated subplots with soil amendments in comparing with untreated others at control. It is obvious during both seasons.

The best improveable amendment was sulphur amended with soil, followed with sulfuric acid in flowering and yield parameters although no significant variation in efficiency between both in numerous yield

parameters. In constrate, the worest one was in untreated plot at control at both seasons of harvest.

3. Effect of foliar applications

All foliar applications had significantly improved effect on all formely yield parameters, in special where compared with untreated one at control during both harvest seasons. The most improvable to flowering and yield parameters was spraying chitosan or yeast extract then silicon at both seasons.

4. Effect of the interactions

The combined interaction between different levels of natural soil salinity× different applied of soil amendments or different foliar applications had significant effect on numerous yield traits during both seasons. However, different soil amendments had a varied and an improved effect between different levels of soil salinity.

The best interaction was combined lower level of natural soil salinity at $5dsm^{-1}$ (area 1) × treated with sulfur and/or sulfuric acid amended with soil.

The best-improved interaction was the combination between lower level of natural soil salinity and applied chitosan and /or yeast extract > silicon followed by high level of soil salinity in the same consequence of foliar applications at both harvest seasons Oppositely to previous interactions, the combined between higher level of natural soil salinity× without any treatment at control was the lower flowering and yield parameters during both seasons.

The most significant improvement to formely yield traits was the combined treatment between sulfur or sulfuric acid as soil amendment and foliar chitosan or yeast extract. Oppositely, the least significant improved

prementioned flowering and yield parameters was untreated one in control during both seasons.

The mostly improved to formally flowering and yield characteristics was the combined interactions among lower natural soil salinity level treated by mixture of sulfur amended with soil and chitosan or yeast extract sprayed plants throughout growth. Oppositely, to that, untreated plants at higher level of soil salinity (Area 2) were least ratio of shelling, seeds weight, and mass yield. It was clear during both seasons of harvest.

D. Quality of productive seeds

Quality of productive seed characters was expressed by the ability of seed for next germination. Germination indices and vegetative indices were detected into the mean of these indices.

1. Effect of salinity

An extremely significant improved was detected in germination quality of productive seeds between both levels of salinity levels. Which productive seeds under high stress of salinity level at 7dsm^{-1} even without any treatment or with treatments had the less germinative and vegetative indices in comparing with its counterpart seeds produced from area 1 at 5dsm^{-1} .

2. Effect of soil amendments

The applied soil amendments had an extremely significant effect on the indices of seeds' quality either germinative or vegetative indices in germinated seeds. Sulphur amended with soil represented the most characteristics of germination quality at the productive seeds followed by sulfuric acid. While, the lowest quality was at productive seeds from untreated cowpea under salinity stress.

3. Effect of foliar applications

All foliar applications had significantly improved in all germination

quality of productive seeds during both seasons. The best application was sparyed chitosan or yeast extract which had a higher quality in productive seed germination. On opposite to that, seeds producted under salinity stress and no treatment at control during both seasons.

4. Effect of the interactions

The most improved seeds for germination was the productive seeds as treated by sulfur or sulfuric acid in association with stress of lower level of natural soil salinity. Oppositely, the worst germinative seeds were productive seeds as affected by higher natural soil salinity.

The most improvable interaction was productive seeds as affected by chitosan or yeast extract protective treatments under soil salinity stress in combining with lower level of soil salinity. In opposite, productive seeds from higher level of natural soil salinity were with control plants.

Meanwhile, The higher quality of productive seeds either in germinative or vegetative traits was produced from plants treated by the addition of sulfur or sulphuric acid amended with soil in combined with chitosan or yeast extract as foliar application. Oppositely, the worst produced seeds were from without any treatments to plants as affected by natural soil salinity.

The best interaction between salinity and treatments of the productive seeds for next germination was the seeds of low level ($5dSm^{-1}$) of natural soil salinity that treated with the combination between sulfur as soil amendment and chitosan or or yeast extract as foliar application, followed by sulfuric acid and chitosan at the same level of soil salinity.