SUMMARY

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Two greenhouse experiments were laid out to study the effect of organic manures {farmyard manure (FYM) and chicken manure (CM)} combined with or without biofertilizers (BF) on wheat plant followed by rocket plant grown in different soils i.e. sandy, calcareous and clayey soils. The wheat experiment comprised ten manure treatments other than the control ones. The organic manures were mixed thoroughly with 5 kg portions of each soil, which was then packed into pots. In the treatments, which received bacterial inoculation, wheat seeds were inoculated with both the associative nitrogen fixing bacteria (***Azospirillum brasilense***) and the phosphate dissolving bacteria (***Bacillus megatherium phosphaticum***) immediately before cultivation.

Wheat plants at the end of vegetative stage (70 days from sowing) were harvested and subjected to determination of some growth parameters besides plant contents of N, P and K as well as the soil chemical parameter analyses.

The rocket plant experiment represents a trial towards investigating the residual effect of the same abovementioned treatments on rocket plant cultivated after wheat harvesting in the same soils without fertilization. After 45 days from cultivation, the rocket plants were cut just above the soil, some growth parameters and the plant contents of N, P and K were estimated. The soil remained in pots after removal of the rocket plants were analyzed for organic matter content, EC, pH and available of N, P and K.

The results obtained could be summarized in the following:

Wheat experiment:

. All the manure treatments whether combined with or without biofertilizers increased significantly the wheat plant dry weights over the control treatments.

. The dry weights of the wheat plants grown on the clayey soil were generally higher than the corresponding ones of the wheat plants grown on both sandy and calcareous soils.

. The highest dry matter weight values were attained due to the treatments of FYM 75% + CM 25% + BF, CM 1oo % + BF and FYM 25% + CM 75% for the sandy, calcareous and clayey soils, respectively.

. The response of the wheat plants to organic manure treatments relative to the control treatment was more pronounced in the sandy and calcareous soils than of the clayey one.

Association of biofertilizers with the organic manure caused insignificant changes in plant dry weight. Some association led to increase the dry weight values whereas some others resulted in decrease in these values.

. The highest values of plant height were achieved due to the treatments of FYM 50% + CM 50% + BF (sandy soil), CM 100% + BF (calcareous soil) and FYM 100 % + BF (clayey soil).

. The changes in values of plant height in response to organic manures were more obvious in sandy and calcareous soils than in the clayey one, although the values of plant height were higher in clayey soil than the calcareous or the sandy one.

The organic manure treatments had significantly increased number of tillers pot^{-1} relative to the control one in sandy and calcareous soils.

. The highest number of tillers pot^{-1} was obtained due to the treatment CM 100 % in the sandy soil, the treatment FYM 25% + CM 75% in the calcareous soil and the treatment FYM 25% + CM 75% in the clayey soil.

. Data also indicate that, the effect of organic manures on number of tillers was more pronounced in the sandy and calcareous soils than in the clayey one, although the number of tillers was higher in the latter soil.

. Application of the organic manure to the tested soil caused the values of N, P and K uptake by wheat plants to be significantly higher than those of the control treatments.

. The highest values of N-uptake were attained due to CM 100 % + BF treatment in the sandy soil, CM 100 % treatment in the calcareous soil (and FYM 25% + CM 75% in the clayey soil.

. The highest values of P-uptake were achieved due to the treatments of FYM 25% + CM 75% +BF, CM 100 % and FYM 25% + CM 75% for sandy, calcareous and clayey soils; respectively.

. The highest values of K-uptake were attained due to the plants treated with CM 100% in both sandy and calcareous soil but in the clayey soil the treatment was FYM 25% + CM 75% in.

. Although values of N, P and K uptake by wheat plant were higher in the clayey soil, yet the response to organic manures was more obvious in the sandy and calcareous soils.

. The application of organic manures to the soils had increased the soil contents of available N, P and K over the control treatment.

. The highest soil contents of available-N were attained due to FYM 75% + CM 25% treatment in the sandy soil, FYM 50% + CM 50% + BF treatment in the calcareous soil and CM 100% treatment in the clayey soil.

. The highest contents of soil available-P were attained due to CM 100% + BF, in the sandy soil and CM 100 % in the calcareous and clayey soils.

. The highest contents of soil available-K were obtained due to the treatments of FYM 100% in the sandy soil, FYM 100% + BF in the calcareous soil) and FYM 50% + CM 50% + BF in the clayey soil.

. The soil contents of available N and K achieved due to the manure treatments were higher in the clayey soil than the sandy or the calcareous one. However, the response to organic manure application was more obvious in the sandy and calcareous soils than the clayey one.

. Regarding the soil organic matter content, all the manure treatments caused it to be higher than the control after wheat harvesting.

- The highest soil organic matter contents were recorded by the treatments of FYM 100 % + BF in the sandy and calcareous soils and calcareous soils and FYM 25% + 75 % and FYM 50% + CM 50% in the clayey soil.

- The response of soil organic matter content to the different treatments was more obvious in the sandy and calcareous soils than in the clayey one in spite of its higher content of the organic matter.

. Neither pH of the soils nor their EC values showed an obvious trend in response to organic manures utilization after wheat harvesting.

Rocket experiment:

. All the manure treatments whether combined with or without biofertilizers increased significantly the rocket dry weight in the sandy and clayey soils in relative to the control treatment. However, this trend was true in the calcareous soil only with the dry weights attained due to CM 100%, CM 100% + BF and FYM 25 % + CM 75 % treatments.

The highest value of rocket dry matter were attained due to the treatment of FYM 25 % + 75 %, FYM 7 % + 25% and CM 100% for the sandy, calcareous and clayey soils, respectively.

. The response of the rocket growth to different organic manure treatments relative to the control treatment was more pronounced in the sandy and clayey soils than in the calcareous.

Association of biofertilizers with the organic manures caused insignificant and significant changes in rocket plant dry weight. Since this association resulted in increases in values of dry weight in some cases, whereas in others treatments results show a decrease in these values.

. The highest rocket plant height values were achieved due to the treatments of FYM 25% + CM 75% (sandy soil), FYM 25% + CM 75% (calcareous soil) and CM 100 % (clayey soil).

. The changes in values of rocket plant height in response to organic manures were more obvious in sandy soil than in the calcareous and clayey ones.

. The highest values of rocket plant N-uptake were attained due to (FYM 25% + CM 75% treatment in the sandy soil), CM 100 % + BF treatment in the calcareous soil and CM 100 % in the clayey soil.

. The highest values of P-uptake were achieved due to the treatments of FYM 25% + CM 75% and FYM 50% + CM 50%, CM 100 % + BF and CM 100 % for sandy, calcareous and clayey soils; respectively.

. The highest values of K-uptake were attained due to the plants treated with FYM 25% + CM 75% treatment in the sandy soil, CM 100% in the calcareous soil and CM 100% in the clayey soil.

. Although values of N, P and K uptake by rocket plant were higher in the clayey soil, yet the response to organic manures was more obvious in the sandy and calcareous soils.

. Soil contents of available-N, P and K after rocket harvesting were less than the corresponding ones after wheat harvesting indicating that the effect

of organic manures tends to decrease with prolonging time. However, all the residues of the manure treatments caused the soil contents of available-N to be higher than that of the control treatment.

. The differences were insignificantly in case of N but were significant in cases of P and K.

. The highest soil contents of available-N after rocket harvesting were due to the treatments CM 100 % + BF in the sandy soil, CM 100 % + BF in the calcareous soil and FYM 100 % + BF in the clayey soil.

. The highest soil contents of available-P in response to organic manures residual effect were attained due to the treatments CM 100 % (sandy soil), CM 100 % + BF (calcareous soil) and CM 100 % + BF (clayey soil).

. The highest soil contents of available-K in response to organic manures residual effect were obtained due to the treatments of FYM 100 % + BF (sandy soil), FYM 100 % (calcareous soil) and FYM 100 % + BF (clayey soil).

. Available N, P and K after rocket harvesting were more obvious in sandy and calcareous soils than in the clayey one.

. The highest contents of soil organic matter after rocket harvesting were attained due to the treatments CM 100 % and FYM 100 % + BF (sandy soil), FYM 100 % (calcareous soil) and FYM 25% + CM 75% (clayey soil).

. The values of both soil pH and EC seemed not to be affected obviously after rocket harvesting.

. This study may lead to conclude that it is possible to substitute the chemical fertilizers with the organic ones such as farmyard or chicken manure, to avoid their hazards effects on the environment and human being. Also, recycling of the plant, animal and human wastes to get these organic manures is of a great value towards the environmental protection from pollution.

. However, from this study it could be recommended to use either CM 100 % + BF or FYM 50% + CM 50 % + BF treatment for both the sandy and calcareous soils. While the treatment of FYM 25% + CM 75 % could be used for the clayey soil.

Finally, it is of importance to note that these recommendations may be decided under same conditions as in this study. It is also advisable to try these organic manures on a large scale in the fields as well as on different crops.