Assessment of some methods for improving the fertility of calcareous soils in nubaria north tahrir egypt

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6. SUMMARYThe main objective of this study is the assessment of some methods for improving the fertility of calcareous soils in Nubaria are&Three field experiments were conducted at Nubaria Agricultural Research Station Farm -North Tahreer- during 1998/1999 and 1999/2000 growing seasons to study the effect of seed inoculation with phosphate dissolving bacteria ”PDB” (under a trade name of PHOSPHORINE) with or without adding mineral P fertilizer to the biological yields and dry weights of wheat (Triticum aestivum L., var. Sakha 8), maize (Zea mays L., var. Single Cross 10) and soybean (Glycin max L., cv. Craw ford).Two laboratory experiments were also conducted. One assesses NH3 volatilization using ammonium sulphate (AS), ammonium nitrate (AN) and urea (U) under field capacity and low moisture levels using broadcast (Br), mixing (Mx) and banding (Bd) techniques. The other assesses the effect of amendments on crust formation, bulk density, total porosity and water holding capacity of calcareous soil. Field experiment No. 1 (wheat experiment):P fertilization treatments (A0 = zero, Al = 6.5, A2 = 13, A3 = 19.5 and A4 = 26kg P/fed) and PDB inoculant treatments (Bo = without inoculation and B1 = with inoculation) were tested onSUMMARY 127wheat yields and NPK in plant, as well as soil pH, and its available P [after 30 and 60 days after sowing and at harvest].Adding P and inoculation with PDB increased wheat grain yield up to as much as 30% by A2B1. An increase of 20% was given by A3B0. Applying over 13kg P/fed had no effect on grain yield. Increase in straw yield was up to 32% by A3B1 and 14% by A3Bo as compared to AoBo.Adding P decreased soil pH in the presence or absence of PDB. Available P in soil increased by adding P as well as by PDB. Thirty days from sowing, there was 9.3mg/kg for AoBo, increased to 16.3mg/kg in A4B0 and 18.2mg/kg for A4131. Sixty days after sowing, comparable values were 7.5, 13.4 and 15.3mg/kg for same treatments, respectively. At harvest time, comparable values were 6.6, 10.9 and 12.2mg/kg, respectively. Effect of treatments was more pronounced on day 60 or more.Plant weight means of A treatments after 30 days were 0.626, 0.660, 0.719, 0.786 and 0.749g/plant for A0, A1, A2, A3 and A4, respectively. Increases over the A2 treatment were not significant. Inoculation did not show significant effect. Sixty days after inoculation (and sowing), effect was marked; means of A treatments were 2.656, 2.895, 3.042, 3.345 and 3.193g/plant for A0, A1, A2, A3 and A4, respectively. Inoculation showed pronounced effect.P uptake was positively affected by P application as well as PDB inoculation treatments.SUMMARY128Field experiment No. 2 (maize experiment):The aim of this experiment was to study the effect of mineral fertilizer phosphorus residual in the soil on maize grown in plots, which had been under wheat. Soil and plant samples were collected 40 and 80 days from sowing and at harvest.Residual phosphorus caused an increase in maize grains and straw yields particularly where P rate was greater 19.5kg P/fed or more. Inoculation with PDB increased yield. The highest yield of 5.079Mg/fed was given by plots, which had received highest P rate (23% increase). Inoculation gave a yield of 4.762Mg/fed compared with 4.271Mg/fed for no inoculation (12% increase).Soil pH was lower in soils previously received P fertilizer and those inoculated with PDB; lowest was with A4B1.Available P was higher in the P-treated soils and with inoculation.Forty days from sowing, available P was 7.08mg/kg with AoBo and 15.78mg/kg with A4B1. Inoculation treatments showed average P of 13.83mg/kg

compared with 10.77mg/kg for no-inoculation (28.4% increase). Eighty days after sowing, the pattern was similar with 29% increase due to inoculation. At harvest time, an increase of 17% occurred due to inoculation.Inoculation with PDB and residual P increased P-uptake. P-uptake of 201mg/plant occurred with inoculation, compared with 180mg/plant with no inoculation (21% increase).SUMMARY 129Field experiment No. 3 (soybean experiment):It was carried out in lines similar to one on wheat Seeds for all treatments were inoculated with Rhizobium.P fertilizer as well as PDB inoculation increased yield. The highest grain yield of 1.142Mg/fed was given by A2B1 (30% increase). Increasing P to 19.5kg P/fed or more did not give further increase in yield. The highest straw yield of 1.786Mg/fed was given by A.4131 (26% increase).Soil pH decreased due to P applications as well as inoculation with PDB.Increasing of P addition was associated with increased available P in soil. Thirty days after sowing, available P increased from 9.07mg/kg for the A0B0 to 16.63mg/kg for A4Bo. The highest available P (18.13mg/kg) was given by A3B1. Sixty days after sowing, P values were 7.65, 13.62 and 16.87mg/kg for the aforementioned treatments, respectively. At Harvest, comparable values were 7.51, 12.75 and 15.30mg/kg for the respective treatments.The highest P-uptake values of 97 and 179mg P/plant was recorded for A2131 in the samples collected 30 and 60 days aftersowing, respectively.Counts of phosphate dissolving bacteria (PDB) were higher for soybean crop (6.65X103 cells/g soil) as compared to wheat crop (5.17X103 cells/g soil). Number of PDB in the inoculation treatments (10.11X103 for soybean and 7.85X103SUMMARY 130cells/g soil for wheat) was much higher than in those without inoculation (3.18X103 for soybean and 2.50X103 cells/g soil for wheat). Bacterial count number was highest in samples collected on day 60 and lowest at harvest time. Laboratory experiment No. 1 (volatilization of ammonia from calcareous soils):Losses by NH3 volatilization under different application methods, broadcasting (Br), mixing with soil surface layer (Mx) and banding (Bd), of different N-sources, ammonium nitrate (AN), ammonium sulphate (AS) and urea (U), under wet and air-dry conditions of the calcareous soils were tested.With field-dry soil ”air-dry soil under field condition”, volatilization losses during the ten days following AS application were 31.6, 40.4 and 17.0% for Br, Mx and Bd methods, respectively. Comparable losses for AN were 48.7, 34.0 and 13.5% and those for U were 14.3, 13.7 and 8.9% for the same methods, respectively. During the period from day 15 to 30, losses from all treatments were very low (< 2mg N/kg); and on day 30, total cumulative losses from AS were 78.7, 84.9 and 47.6mg N/kg, and those from AN were 82.4, 67.6 and 35.8mg N/kg; and those from U were 42.1, 39.1 and 30.5mg N/kg for the Br, Mx and Bd methods, respectively. Thus 13d and urea fertilizer proved to be the best methods.Under wet soil (field capacity) conditions, NI-13-N losses during three days were high from AS, 19.1, 22.2 and 9.3%, medium from AN, 12.6, 12.5 and 5.4%, and low from urea, 6.2,SUMMARY 1315.7 and 2.3% for Br, Mx and Bd application methods, respectively. After 10 days, losses from AS were 45.8, 48.7 and 23.9mg N/kg; those from AN were 30.8, 28.2 and 16.1mg N/kg and those from U were 41.9, 38.0 and 15.3mg N/kg for Br, Mx and Bd methods, respectively. Highest daily N-losses from NH4 sources occurred 3 days after application. For urea, highest was on day 6 after application. Highest losses (in mgN as NH3 per kg soil) for each source and each method were as follows:AS:8.5 (Br), 7.5 (Mx) and 4.0 (Bd) occuring in day 3 for each case,AN: 4.5 (Mx in day 2), 4.6 (Br in day 3) and 2.1 (Bd in day 3), U:8.1 (Br in day 6), 6.9 (Mx in day 6) and 2.1 (Bd in day 3). Laboratory experiment No. 2 (surface crust and soil amendments):Treatments were farmyard manure (FYM), wheat straw (WS), soybean straw (SS), gypsum (GYP), sulphur (SUL) and no-amendment (NONE) with two levels of soil moisture contents: moist; water holding capacity (25% moisture on mass basis) and wet; saturated (50% moisture). Emergence of wheat seeds, moisture content (mc), soil strength (ss) and bulk density (bd) were measured. Assessments of soil properties were done in three phases: after 30, 60 and 120 days from sowing.For moist treatment, seed emergence was 100% for FYM, 95% for WS or SS, 90% for GYP or SUL and 75% for NONE. Under saturation conditions, emergence values were 95% forSUMMARY 132FYM, 90% for WS or SS or SUL treatments, 85% for GYP and 80% for NONE treatment.Bulk density decreased by organic amendment particularly after 60 days (phase 2) under field capacity conditions and after 30 days (phase 1) under saturation conditions. Bulk density values were 1.33-1.37g/cm3 for NONE compared with 1.24-1.30g/cm3 for organic amendments. Amendments were more effective when soil was wet rather than moist.Soil moisture contents were

higher for all amendment treatments as compared with non-amended soil.Compressive strength of the soil surface was decreased with the addition of organic amendments. Soil strength values were lower under field capacity than under saturation conditions.Therefore, it may be concluded that application of organic residues improves physical properties of calcareous soils giving soil with decreased problems for plant growth.SUMMARY 133