

## USE OF NATURAL NITROGEN STABILIZERS TO IMPROVE NITROGEN USE EFFICIENCY AND WHEAT CROP YIELD

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**ABSTRACT.** Complex nature of nitrogen fertilizer in soil and poor management practices are major causes of low fertilizer use efficiency in Pakistan. These factors further increases nitrogen losses in form of nitrate leaching and volatilization of ammonium, as well as nitric oxide which are burning economic and environmental threats. Keeping in view the demand of urea application in Pakistan and its low efficiency, we hypothesized that appropriate urea management with neem formulations or biofertilizers can enhance the nitrogen use efficiency. We designed experiment with treatments: T0 (N0 application), T1 (recommended nitrogen), T2 (recommended nitrogen + biofertilizer), T3 (recommended nitrogen + neem seed extract), T4 (75% recommended nitrogen + biofertilizer), T5 (75% recommended nitrogen + neem seed extract), T6 (recommended nitrogen + biofertilizer + neem seed extract), T7 (75% recommended nitrogen + biofertilizer + neem seed extract) in wheat crop. The experiment was laid out in randomized complete block design (RCBD) with split plot arrangements. Different approaches for stabilized nitrogen fertilizer responded significantly for the wheat plant height, tillers per plant, number of grains per spike, 1000-grain yield, grain yield and harvest index. Result exhibited that wheat crop enhanced yield attributes and finally the yield under treatment T6 and T7 for both wheat cultivars. Treatments comparison with recommended nitrogen (T1) revealed that all treatments with biofertilizer, as well as with neem seed, enhanced crop performance along with nitrogen use efficiency. It can be concluded that nitrogen fertilizer can be stabilized in the soil with the use of different natural products for sustainable crop production.

**Keywords:** field experiment; fertilizer; neem seed extract; biofertilizer; yield attributes.

## THE ROLE OF BIOSTIMULANTS IN INCREASING BARLEY PLANT GROWTH AND YIELD UNDER NEWLY CULTIVATED SANDY SOIL

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**ABSTRACT.** Two field experiments were done at a private farm in Kalabsho and Zayian district, Dakhliya Egypt, throughout 2014/2015 and 2015/2016 seasons, to evaluate the promotive role of chitosan (Chi, 250 and 500 mg/l) and/or sodium metasilicate (Si, 125 and 250 mg/l) foliar application on barley growth, yield, and some physiological attributes in newly reclaimed soil. Application of Si or Chi concentrations showed an improvement in plant growth as: plant height, tiller number per plant, flag leaf area and shoot dry weight; photosynthetic pigments; organic osmolytes; ion percentage, as well as yield and its quality in both growing seasons. Generally, the application of Si gave higher values in most cases than Chi application in the experimental year. It was concluded that application of 125 mg/l sodium metasilicate twice at 50 and 70 days from sowing is advantageous to improving plant growth and productivity under newly reclaimed soils.

**Keywords:** chitosan; *Hordeum vulgare* subsp. *vulgare* L.; silicon; yield.

## ENHANCING THE SOLUBILITY AND RECLAMATION EFFICIENCY OF GYPSUM WITH H<sub>2</sub>SO<sub>4</sub>

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**ABSTRACT.** An effective reclamation procedure of saline sodic soils is removal of undesirable Na<sup>+</sup> by addition of some Ca<sup>2+</sup> source paralleled with leaching of this sodium out of root zone. Nevertheless, gypsum being a direct source of Ca<sup>2+</sup> is relatively insoluble in water. Its solubility can be increased with addition of H<sub>2</sub>SO<sub>4</sub>. Therefore, three years (2015 to 2018) study was plan to find out the optimal and economical level of H<sub>2</sub>SO<sub>4</sub>, which can increase the solubi-lity and reclamation efficiency of gypsum for saline sodic soil in rice wheat crop-ping rotation. Treatments included were: T<sub>1</sub>, Control, T<sub>2</sub>, gypsum @ 100% of GR, T<sub>3</sub>, gypsum @ 100% of GR+10 kg H<sub>2</sub>SO<sub>4</sub> acre<sup>-1</sup>, T<sub>4</sub>, gypsum @ 100% of GR+50 kg H<sub>2</sub>SO<sub>4</sub> acre<sup>-1</sup>, T<sub>5</sub>, gypsum @ 100% of GR+100 kg H<sub>2</sub>SO<sub>4</sub> acre<sup>-1</sup>. Before start of study, soil had pH<sub>s</sub> = 8.85, EC<sub>e</sub> = 4.85 (dS m<sup>-1</sup>), SAR = 43.82 (mmol L<sup>-1</sup>)<sup>1/2</sup>, GR = 4.10 (t. acre<sup>-1</sup>), BD = 1.65 (Mg m<sup>-3</sup>), HC = 0.33 (cm hr<sup>-1</sup>). Experiment was laid out in RCBD with three replications. Sulfuric acid and gypsum were applied (once) at the start of study in the respective treatment plots. Recommended dose of fertilizers, 150-90-60 NPK kg ha<sup>-1</sup> for rice (Shaheen Basmati) and 160-114-60 NPK kg ha<sup>-1</sup> for wheat (Faisalabad, 2008) was applied. Yield and yield determining attributes of each crop were recorded at physical maturity. After harvest of each crop, soil samples were collected and were analyzed for EC<sub>e</sub>, pH<sub>s</sub>, SAR, bulk density and hydraulic conduc-tivity. Pooled data analysis revealed that maximum growth and yield determining factors of rice and wheat were recorded where gypsum was applied with H<sub>2</sub>SO<sub>4</sub> at the rate of 50 and 100 kg acre<sup>-1</sup>. Soil physical and chemical properties, *i.e.* pH<sub>s</sub>, EC<sub>e</sub>, SAR bulk density and hydraulic conductivity were also substantially improved with combined application of gypsum and H<sub>2</sub>SO<sub>4</sub> at the end of study. Both levels of H<sub>2</sub>SO<sub>4</sub> at the rate of 50 and 100 kg acre<sup>-1</sup> with gypsum proved equally to be the best in enhancing the solubility and reclamation efficiency of gypsum and showed the statistically ( $p \leq 0.05$ ) similar results in increasing the yield of rice and wheat crop and improving the soil physical and chemicals properties. Therefore, H<sub>2</sub>SO<sub>4</sub> at the rate of 50 kg acre<sup>-1</sup> is recommended as most economical and optimum level, which can be used with gypsum as an effective ameliorative strategy for the salt affected soils.

**Keywords:** salinity; rice; wheat; amelioration; amendments.

## POST-HARVEST LOSSES ALONG THE RICE VALUE CHAIN IN KWARA STATE, NIGERIA: AN ASSESSMENT OF MAGNITUDE AND DETERMINANTS

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**ABSTRACT.** Post-harvest losses, particularly along the rice value chain, have been highlighted as a major source of reduction in revenue among the value chain actors. It is therefore imperative that empirical assessment of the magnitude and determinants be investigated, so as to be able to provide a reliable policy stand that can help reduce these

losses. Patigi and Edu local government areas were purposively sampled from Kwara state, Nigeria, since they are the major producers of rice in the State. Data were gathered through the use of a questionnaire from 40 rice farmers, 40 rice processors and 40 rice marketers. Descriptive statistics and multiple linear regression model were used to analyze the data. The result showed that the loss was highest for farmers at 41-50 kg (₦14402.40) (1 Naira = 0.002772 U.S. \$), 31-40 kg (₦2383.20) for processors and at less than 11 kg (₦398.30) for the marketers. Household size and farm size were significant at 1% in determining post-harvest losses for farmers, while only the household size was significant in determining post-harvest losses for processors. It was thus recommended that efficient milling machine should be introduced, particularly to rural rice processors, such that quality grains can be achieved.

**Keywords:** farmers; farm size; milling; processors.

## **THE IMPACT OF SOIL AMENDMENT OF SUPER ABSORBENT POLYMER ON GRAIN YIELD AND YIELD COMPONENTS OF CORN IN CENTER OF IRAN**

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**ABSTRACT.** Corn is one of the most important cereal crop grown in Iran. A complete randomized design with four replications was used to analysis the influence of soil amendment of super absorbent polymer on grain yield and yield components of corn in center of Iran in 2016 and 2017. Treatments with super absorbent polymer were 0 kg/ha (S1), 15 kg/ha (S2), 30 kg/ha (S3), and treatments with fertilizers were 50% (F1), 75% (F2), 100% (F3), which could be combined into nine pots. The influence of super absorbent polymer was significant on spike weight in 2017, above-ground biomass in 2016, one hundred seed weight in 2016, and grain yield in 2017. There was no meaningful influence of super absorbent polymer on spike weight in 2016, above-ground biomass in 2017, 100 seed weight in 2017 and grain yield in 2016. Fertilizer treatments had significant influence on spike weight, above-ground biomass, 100 seed weight, and grain yield in both 2016 and 2017. The interaction between SAP and fertilizers had significant effect on above ground biomass in 2017. In both years, the highest spike weight, above ground biomass, 100 seed weight and grain yield was related to S3 (30 kg/ha), followed by S2 (15 kg/ha) and S1 (0 kg/ha), respectively. 100% application of fertilizer (F3) had obtained the maximum spike weight, above ground biomass, 100 seed weight and grain in both 2016 and 2017. Our data have shown that the applied SAP had a remarkable effect on corn growth and yield under different fertilization treatments, and its application of 30 kg/ha gave the best corn production index.

**Keywords:** maize; grain yield; 100 seed weight; fertilizer.

## **THE RELATIONSHIP BETWEEN CHLOROPHYLL CONTENT AND ANTIOXIDANT ACTIVITY OF ABIES ALBA AND NEPETA PANNONICA EXTRACTS ACCORDING TO PHENOPHASE AND HARVESTING AREA**

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**ABSTRACT.** *Abies* and *Nepeta* species are well known for their traditional use in traditional medicine from Bukovina, Romania, and other parts from the world. However, too few studies present the connection between phenophase, chlorophyll content and antioxidant activity of extracts obtained from medicinal plants. Phenophases, like stages from vital cycle of plants, involve seasonal and evolutionary changes, including chlorophyll content of the leaves. With these changes, there are also changes in the oxidative activity of the extracts obtained from the studied plants. The chlorophyll was extracted with acetone, being quantitatively measured using the spectro-photometer. Antioxidant activity was determined by the DPPH method. This method is one from the most popular ways to measure the antioxidant capacity of a substance. The studied species are *Abies alba* and *Nepeta pannonica*. Plants were harvested from different locations of Bukovina, from areas of Câmpulung Moldovenesc and Cacica localities, Suceava county, Romania. Chosen phenophases were growing and flowering. The DPPH method implies making some extracts with organic solvents from collected plants, in this case being acetone. Using 2,2-diphenyl-1-picrylhydrazil reactive, there was determined the antioxidant capacity of mentioned extracts. There were observed variations of this depending of phenophase and collecting areas, being closely related to total chlorophyll content. The both species have behaved differently and obtained results can be used to determine the optimal harvest moments of these plants.

**Keywords:** growing; flowering; medicinal plants; spectrophotometer.

## **EFFECT OF DIFFERENT TILLAGE IMPLEMENTS AND GYPSUM FOR FODDER PRODUCTION IN SALT AFFECTED SOILS USING HIGH RSC WATER**

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**ABSTRACT.** Selection of suitable tillage implement, as well as amendments, is very important for the reclamation of salt affected soils. For this purpose, a field study was performed using the different rates of gypsum and tillage implements for the production of sorghum and berseem fodders in salt affected field using high RSC water. Treatments including were T1: control (cultivator twice), T2: modified chisel plough (twice), T3: chisel plough (twice), T4: modified chisel plough (twice) + gypsum application @ 100% GR of soil, T5: modified chisel plough (twice) + gypsum application @ 50% GR of soil, T6: chisel plough (twice) + gypsum application @ 100% GR of soil, T7: chisel plough (twice) + gypsum application @ 50% GR of soil. A moderately salt affected field { $EC_e = 5.37$  (d Sm<sup>-1</sup>), pHs = 9.18, SAR = 34.01 (m mol L<sup>-1</sup>)<sup>1/2</sup> and GR 3.10 t acre<sup>-1</sup>} was selected. Field was leveled, prepared and gypsum was applied according to treatment

plan, followed by leaching. Tubewell water {EC<sub>w</sub>= 1.34 dS m<sup>-1</sup>, RSC= 8.50 me L<sup>-1</sup> and SAR= 12.72 (mmol L<sup>-1</sup>)<sup>1/2</sup>} was used for irrigation. Gypsum was also applied before sowing of each crop on RSC basis of water. The trial was performed in the RCBD design with three replications. Pooled data of three years showed that maximum fodder yield of sorghum (38.44 t ha<sup>-1</sup>) and berseem (60.21 t ha<sup>-1</sup>) was recorded with modified chisel plough (twice) + gypsum @ 100% GR of soil. Data regarding the soil qualities revealed that soil pHs, E<sub>Ce</sub>, SAR and BD decreased by 4.24, 30.72 and 31.37, respectively, while HC was increased by 130 % with use of modified chisel plough (twice) + gypsum @ 100% GR of soil, as compared to control.

**Keywords:** berseem; sorghum; brackish water; chisel plough; salinity.

## QUANTIFICATION OF GERMINATION RESPONSE OF MILLET (*PANICUM MILIACEUM* L.) SEEDS TO WATER POTENTIAL AND PRIMING USING HYDROTIME MODEL

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**ABSTRACT.** Seed germination is a complex biological process that is influenced by different environmental physical factors including temperature, water potential, salinity, pH and light, as well as intrinsic genetic factors. In such environments, the water needed for germination is available for only a short time, and consequently, successful crop establishment depends not only on rapid and uniform germination of the seedlot, but also on its ability to germinate under low water availability. All of these attributes can be analyzed through the hydrotime model (HT). Millet (*Panicum miliaceum* L.) is cultivated in arid and semi-arid regions of Iran. Therefore, in this study, using the hydrotime modeling approach, germination response of millet to priming (water and gibberellin 50 ppm at 15°C for 24 h) and water potential (0, -0.3, -0.6, -0.9, and -1.2 Mpa) was studied. Hydrotime (HT) model were fitted to cumulative germination of seeds and recorded in germination tests carried out at different water potentials (0, -0.3, -0.6, -0.9 and -1.2 MPa) and priming treatments (control, hydropriming and hormone priming). Results showed that, germination of millet decreased significantly with reduction of osmotic potential. Results indicated that the hydro-time constant (θH) for control, hydro-priming and hormone priming were 0.89, 0.79 and 0.67 MPa d, the water potential (Ψ<sub>b</sub>(50)) for control, hydropriming and hormone priming were -0.89, -0.94 and -1.11 MPa, respectively. Results indicated that the use of hydrotime model in germination prediction could be useful to provide more accurate estimates for the timing of sowing and management of millet.

**Keywords:** : base temperature; base water potential; germination prediction; hydrotime; *Panicum miliaceum* L.

## ECO-FRIENDLY MANAGEMENT OF FLOWER THRIPS AND POD BORERS OF MUNGBEAN THROUGH SESAME INTERCROPPING

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**ABSTRACT.** Effectiveness of sesame intercropping in mungbean for the management of flower thrips and pod borer of mungbean was studied at Pulses Research Centre, Ishurdi,

Pabna, Bangladesh, during two consecutive season of kharif-I 2017 and 2018. Sesame intercropping in mungbean reduced flower thrips infestation and pod borer infestation significantly in both the years. Among the intercropped treatments, mungbean: sesame at 2:2 row ratio arrangements was found the best intercropping arrangements in reducing flower thrips and pod borer infestation. Sesame intercropping showed statistically similar performance in reducing pod borer infestation, as like as insecticide spraying (Imitaf 20 SL @ 0.5 ml/l). Mungbean equivalent yield varied depending on the prevailing weather condition of the cropping season and market prices of both mungbean and sesame, but the total production was always higher in intercropped treatments than sole cropping of mungbean. Hence, sesame intercropping in mungbean might be eco-friendly management approach against flower thrips and pod borers of mungbean providing higher production and benefit.

**Keywords:** thrips infestation; borer infestation; row ratio arrangement; insecticide spraying.

## **ESSENTIAL OIL COMPOSITION OF THYMUS TRAUVETTERI KLOKOV & DESJ. AT DIFFERENT GROWING ALTITUDES IN MAZANDARAN, IRAN**

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**ABSTRACT** *Thymus trauvetteri* Klokov & Desj. (Lamiaceae) is a permanent species that grows in some mountain rangeland of Iran including Mazandaran province. The aerial parts of *Thymus trauvetteri* were collected during flowering stage in June 2014, from mountain rangelands of Mazandaran province, in North of Iran. Around samples collected from four altitudes (2100 m, 2400 m, 2700 m and 3000 m) in mountain region of Mazandaran province. The goal of current research was to assess the effect of altitude on the chemical composition and function of essential oil in *Thymus trauvetteri*. The essential oil were obtained by hydrodistillation and analyzed by gas chromatography (GC) and gas spectrometry (GC-MS). Based on the results, the essential oil content is between 1.01-1.51% at different altitudes. The highest essential oil (1.51%) was extracted at an altitude of 2400 m, while it was opposite (1.01%) at an altitude of 3000 m. The main compounds essential oil of *Thymus trauvetteri* samples were identified: thymol (5.93%-49.75%), carvacrol (1.78%-54.02%), and p-cymen (6.98%-19.07%). According to the results, altitude was significantly ( $p \leq 0.05$ ) effective on essential oil, thymol, carvacrol and p-cymen rates according to results of correlation analysis. The highest percentage of essential oil is at an altitude of 2400 m and the lowest is 3000 m above sea level. The highest percentage of thymol is in L3 (2700 m) and lowest is in L1 (2100 m). The highest percentage of carvacrol is in L3 (2700 m) and lowest is in L4 (3000 m). The highest percentage of p-cymen is in L1, L2, L3 (2100, 2400 and 2700 m, no significant difference) and lowest is in L4 (3000 m). Variations in essential oil rates and compositions may be due to on genetic, ecological or individual variability.

**Keywords:** thymol; carvacrol; mountain rangelands.