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A REVIEW ON SEED PRE-SOWING TREATMENTS IN FORESTRY APPLICATIONS

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Abstract: Seed dormancy is one of the major hurdles in germination which can be conquered by following some treatments which are termed as pre-sowing treatments. The dormancy of the seeds can be broken by following different pre-sowing treatments like scarification (mechanical, acid), water soaking (hot/cold), using chemicals and plant growth regulators or by alternate wetting and drying prior to sowing. The type of treatment chosen depends on the type of dormancy exhibited by seed. The technological advancement laid forth a road map for improving traditional seed treatment technologies and developing new ones, such as priming, irradiation using gamma rays, magnetic exposure of seeds for enhancing germination. Another advanced technology which has found applications in all most all existing fields of science is nanotechnology which is now showing promising effect in seed germination. Lack of awareness in identifying suitable pre-sowing seed treatments for various tree species is an important concern for mass production and conservation of many species. In order to tackle this issue, some efforts are made to discuss selected seed treatments with their advancement and significance in this review.

Keywords: Dormancy, Scarification, Irradiation, Plant growth regulators, Nanotechnology

SIGNIFICANCE OF HYDROGEL AND ITS APPLICATION IN AGRICULTURAL SECTOR

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Abstract: The use of water-holding amendments such as hydrogel polymers for improving water and nutrient use efficiency will become more important over time, especially in arid and semiarid regions with limited water availability. The hydrogel is able to retain water and plant nutrients and release them to the plants when the surrounding soil near the root zone of the plants begins to dry up. Water management is currently regarded as one of the most significant challenges facing all countries in arid and semi-arid regions; in fact, global water demand is expected to be 50% higher by 2030 than it is today, resulting in water scarcity; at the same time, the agricultural sector consumes over 70% of freshwater in most parts of the world. According to research, when soil is treated with a water hydrogel composite, its water volumetric content increases dramatically, and when the surrounding soil dries, the stored water is gently released back into the soil. The hydrogel improves plant viability, ventilation, and root development, resulting in more efficient water consumption, lower irrigation costs, and longer irrigation intervals. It also improves soil's water holding capacity and porosity, providing plants with eventual moisture and nutrients, as well as improving plant viability, ventilation, and root development, resulting in a more conducive environment for better plant growth and, ultimately, increased crop yield. Hydrogels have a number of properties that support their usage as fertilizer release systems and soil conditioners in agricultural applications, such as high swelling and slow water retention. The agricultural sector benefits from hydrogel polymers because they can retain water and decrease soil erosion.

Keywords: Hydrogel, Soil conditioner, Water holding capacity, Crop yield, Nutrient efficiency

A REVIEW ON VEGETATIVE PROPAGATION AND APPLICATIONS IN FORESTRY

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Abstract: Vegetative propagation is a remarkable tool for improving the quality of forest tree planting stock. It is widely used as a means of genotype preservation in clone banks and seed orchards. Low quality seed and poor germination rates affect the availability of planting stock in such case vegetative propagation is the best alternative. This review paper describes about the various techniques of vegetative propagation which includes macropagation with cuttings, grafting, layering and Micropropagation via tissue culture. The technological advancement laid forth a road map for improving traditional propagation techniques and developing new ones such as condensed node proliferation technique, excised bud technique, hydroponics and somatic embryogenesis. but despite this, the possibility of vegetative propagation using hormones is not clear for many indigenous tree species. So, this review also includes role of plant growth regulators in improving success of reproducing species. Lack of knowledge and skill is the major hurdle to use vegetative propagation. So, an attempt was made to discuss various techniques with their advancement and significance.

Keywords: Vegetative propagation, Macro propagation, Micro propagation, Plant growth regulators

REVIEW ON EFFECT OF SOWING DATES ON SESAME (*SESAMUM INDICUM* L.) GROWTH AND YIELD

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Abstract: Sesame is grown in India during kharif, rabi and summer seasons. It is grown both in *kharif* and *rabi* in parts of Maharashtra, Madhya Pradesh, Chhattisgarh, Gujarat, Odisha and also as summer crop after late paddy or potato in Odisha and in all the seasons in parts of Southern India. Among the factors necessary for successful production of crop, time of sowing can have a major effect on final size of plants and the yield. Optimum sowing time may vary from one variety to another and also from one region to another due to variation of agro-ecological conditions. Yield decreases progressively with the delay in planting from optimum time of sowing. For successful production of crop many factors, such as, quality seed, weed control, proper fertilization, irrigation, method of sowing, optimum sowing time, seed rate, and time of harvest are indispensable. Changes in the growth and development of the sesame (*Sesumum indicum* L.) plant induced by varying planting dates have not been fully studied.

Keywords: Sesame, Kharif, Rabi, 1000- Seed weight, Capsules per plant, Seed yield

EVALUATION OF MICRONUTRIENT AVAILABILITY AS INFLUENCED BY MANURE AND FERTILIZER APPLICATION: A REVIEW

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Abstract: Under various cropping systems, the combined application of manures and fertilizers played a critical role in improving soil physico-chemical characteristics and micronutrient distribution. Micronutrients in the soil are just as significant as macronutrients, and hence have an impact on soil fertility. Intensive cropping practices cause shortages in Zn, Cu, Fe, and Mn in surface and subsurface soil, which can be remedied by applying manures and fertilizers together. The goal was to look at how organic manures and inorganic fertilizers could be used to boost micronutrient availability. When organic manures are used in conjunction with chemical fertilizers, the biological activity increases, and the availability of micronutrients improves as well. Organic matter also acts as a chelating agent, making micronutrients more soluble.

Keywords: Micronutrients, Soil fertility, Manures and fertilizers, Availability

MODELLING POTENTIAL SPREAD OF OIL PALM BAGWORM, *METISA PLANA* (LEPIDOPTERA: PSYCHIDAE) IN INDIA WITH MAXENT APPROACH

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Abstract: Oil palm bagworm, *Metisa plana* (Lepidoptera: Psychidae) is a serious insect pest of oil palm, *Elaeis guineensis* Jacq. in India. The pest is reported to cause severe defoliation on oil palm in oil palm gardens located in Andhra Pradesh, India. Hence, ecological niche modelling study was attempted to identify climate suitable locations for the pest spread in India as area under oil palm cultivation is expanding. Geographical coordinates of 37 pest presence sites, world climate grid files, nineteen bioclimatic variables, MaxEnt software, DIVA-GIS were used for the construction of ecological niche model of *M. plana*. The model indicated potential geographical locations (districts) in seven states viz., Andhra Pradesh, Karnataka, West Bengal, Kerala, Odisha, Telangana and Tamil Nadu for the spread of pest in India. One of the interesting predictions emerging from this study is that the pest is not likely to spread to North Eastern states of India and Eastern States, Andaman and Nicobar Islands, Gujarat, Goa, Maharashtra and Chhattisgarh. The predictions of potential distribution of the pest arrived at in this study should help in developing strategies for monitoring and managing this defoliator of oil palm.

Keywords: Bagworm, *Metisa plana*, DIVA-GIS, Max Ent model, Oil palm, India

INDUCTION OF DEFENCE RESPONSES IN SOYBEAN AGAINST *XANTHOMONAS AXONOPODIS* BY COPPER-CHITOSAN NANOPARTICLES

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Abstract: Inefficient and excessive use of inorganic fertilizers and pesticides causes environmental risks. Concurrent with the recent increase in agricultural productivity, agricultural systems are now also recognized to be a significant source of environmental damage. Chitosan is a biocompatible, biodegradable and nontoxic polymer with various applications. In the present investigation, the efficacy of Cu-chitosan nanoparticles (NPs) to boost defense responses against *Xanthomonas axonopodis* sp. *glycines* were evaluated. *X. axonopodis* causes Bacterial Pustule disease in soybean. Cu-chitosan NPs treated plants showed significant defense response through higher activities of antioxidant (SOD and POD) and defense enzymes (PPO and PAL). Significant control of Bacterial pustule disease of soybean was recorded at 0.06% concentration of Cu-chitosan NPs treatments in pot and field condition. The potential of Cu-chitosan NPs in this study anticipated that developed NPs could be further exploited in large scale experiments.

Keywords: Chitosan, Cu-chitosan, Nanoparticles, Bacterial pustule, Defence enzymes

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INTEGRATED NUTRIENT MANAGEMENT FOR MAXIMUM YIELD OF SUGAR BEET IN TERMS ETHANOL AND SUSTAINABLE SOIL HEALTH

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Abstract: The present investigation entitled to evaluate the effect of nutrient management on the growth and productivity of three different varieties of sugar beet (*Beta vulgaris*.) namely LKC-2000, Subhra and LS-6 in agriculture farm of NSI, Kanpur carried out during two consecutive years 2018-2019 and 2019-2020. The seeds were procured from Indian Institute of Sugar Cane Research, Lucknow. Ten treatments using different Rates of alternative (STR) and conventional (FP) fertilizers were take viz T₁ as (Control) - N₁₂₀P₆₀K₆₀; T₂ as (FP) -N₁₅₀P₆₀K₆₀; T₃ as (100% STR) - N₁₄₀P₇₂K₄₀; T₄ as (125% STR) - N₁₇₅P₉₀K₅₀; T₅ as N₁₅₀P₆₀K₆₀ (FP) + 5 t FYM; T₆ as N₁₅₀P₆₀K₆₀ (FP) + 1 t Vermi (FP); T₇ as N₁₄₀P₇₂K₄₀ (100 % STR) + 5 t FYM; T₈- N₁₄₀P₇₂K₄₀ (100 % STR) + 1 t Vermi; T₉ as N₁₇₅P₉₀K₅₀ (125 % STR) + 5 t FYM and T₁₀ as N₁₇₅P₉₀K₅₀ (125 % STR) +1 t Vermi. Results from the experiment revealed that use of 100% STR & 125% STR alone and along with standard dose of FYM and vermi significantly increased plant height, root length, root diameter, fresh and dry weight of root, root yield and nutrient uptake (NPK) of sugar beet than sole use of NPK ie control (T₁) as well as FP (T₂). All the three varieties of sugar beet similarly responded to the treatments but LKC-2000 and Subhra responded comparatively best than LS-6 variety. LKC-2000, gave the highest value of total reducing sugar (18.29%) followed by Subhra (17.95 %) & LS-6 variety (17.60 %). LKC-2000 gave ethanol yield of around 129.4 AL/ton followed by Subhra with 119.6 AL/ton and LS-6 with 101.26 AL/ton.

Keywords: Sugar Beet, Ethanol, Energy, Biofuel, Total Reducing Sugar

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PERFORMANCE OF SUGARCANE VARIETIES UNDER DIFFERENT IRRIGATION REGIMES IN PRE- MONSOON PERIOD IN NORTH WESTERN INDO GANGETIC PLAINS

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Abstract: Drought is the most limiting environmental factor to reduce potential sugarcane productivity among various biotic and abiotic constraints. A field experiment was conducted to investigate the effect of water stress on early and mid-late categories of six sugarcane varieties with three irrigation regimes (IW/CPE) i.e. at 1.0, 0.6 and 0.3 with four replications during 2020-21 at Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Karnal (Haryana), India. The results showed that germination per cent did not differ significantly among different irrigation regimes at 30 and 45 days

after planting (DAP). At 0.3 irrigation regime, maximum number of tillers were recorded in Co 05011 (120.3 and 113.2), while in CoH 160 (150.4, 131.3) at 0.6 IW/CPE at 100 and 150 DAP, respectively. The results have shown that varieties Co 0238, CoH 167, Co 05011 and Co 0118 recorded significantly highest dry matter accumulation in early as well as grand growth phase than CoH 160 and CoH 119. CoH 167 followed by Co 05011 and Co 0238 produced significantly higher NMC and noted 19.21% and 7.21% reduction in NMC at 0.3 and 0.6 irrigation regime as compared to 1.0 irrigation regime level. Cane yield was significantly affected under low irrigation regime in all the tested varieties. Significant reduction of 31.13 and 12.3% in cane yield was recorded at 0.3 and 0.6 irrigation regime as compared to 1.0 irrigation regime. Among the varieties, CoH 167 (104.5 t ha⁻¹) produced significantly higher cane yield which was at par with Co 0238 (104.3 t ha⁻¹) and the lowest cane yield was reported in varieties Co 0118 (77.6 t ha⁻¹).

Keywords: Cane yield, Drought, Irrigation regimes, IW/CPE ratio, Sugarcane

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DIVERSITY ANALYSIS IN ADVANCE LINES OF DESI COTTON (*GOSSYPIMUM ARBOREUM* L.) USING SSR MARKERS

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Abstract: 30 advance lines of desi cotton were used for this study. Total 22 polymorphic markers amplified 62 bands with an average of 2.81 bands per marker. The band fragment size ranged from 120-380 bp. The polymorphism information content (PIC) ranged from 0.234 to 0.767 with an average of 0.518. BNL4108 marker gave maximum polymorphism with PIC value 0.767. HD526 and HD535 are most similar accessions with highest value of similarity matrix, 0.956. NAU2336 revealed least polymorphism with PIC value 0.234 and 2 different allele sizes. Significant diversity was found among all 30 genotypes even at molecular level and all the 30 genotypes were grouped into 4 clustered by polymorphism information of 22 SSR markers.

Keywords: Desi cotton, Diversity, Hisar, NTSYS-PC, SSR markers

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ISOLATION AND EVALUATION OF ANTAGONISTIC PLANT GROWTH PROMOTING RHIZOSPHERIC BACTERIA FROM CHICKPEA

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Abstract: Chickpea is an economically most important significant crop. Plant growth-promoting bacteria have been proved as potential tools not only for improving plant growth and development but also to protect host plants from stress conditions and pathogens. The present research is aimed to isolate bacteria from the rhizosphere of chickpea and to evaluate their antagonistic activity against *Fusarium oxysporum* and Plant growth promoting properties. A total of twenty one bacteria were isolated from four sampling sites, Out of which seventeen have displayed antagonistic activity against the pathogen of chickpea wilt. Among these seventeen isolates, eleven were able to produce ammonia production, nine were able to produce Indole-3-acetic acid in tryptophan-supplemented medium, fourteen were able to solubilize inorganic phosphate in vitro and seven were able to solubilize zinc.

Keywords: PGPR, Chickpea, PGP traits, *Fusarium oxysporum*

PERFORMANCE OF SALT TOLERANT MUSTARD VARIETIES UNDER DIFFERENT FERTILITY LEVELS

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Abstract: There is a lack of sufficient research information pertaining to the effect of salt tolerant varieties and varying fertilizer levels on yield of mustard in Haryana. This calls for a need to generate more information on the performance of mustard to different varieties and fertilizer levels. Keeping in views the above facts a field experiment was conducted during Rabi season of 2020-2021 at Research farm of CCSHAU Regional Research Station, Rohtak. The objective of the experiment was to find out optimum fertilizer requirement of salt tolerant mustard varieties. The soil of the experimental field was sandy loam in texture, neutral in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in Split plot design with four mustard varieties viz. V₁:CS54, V₂: CS58, V₃: CS60 and V₄: RH 725 in main plot and four fertility levels viz. F₁: Control, F₂: 100 % RDF, F₃: 125 % RDF and F₄: 150 % RDF in subplot with three replications. Results revealed that Mustard variety RH 725 took significantly more number of days for flowering and maturity while variety CS 54 took least number of days to flowering and maturity. RH 725 produced significantly taller plants as compared to other varieties whereas; CS 54 produced smallest plants which were at par with CS 58. Similarly mustard variety RH 725 produced significantly more number of primary and secondary branches/plant, siliqua length, number of seeds/siliqua and 1000 seed weight as compared to other varieties. Moreover, RH 725 also produced significantly higher grain; straw and biological yield. Increasing fertility levels from 100% RDF to 150 % RDF delayed the maturity of mustard crop. There was significant increase in plant height, siliqua length, number of seeds/siliqua and 1000 seed weight of mustard with the increasing levels of fertilizers. Application of 150 % RDF being at par with 125% RDF recorded significantly higher grain, straw and biological yield of mustard.

Keywords: Fertility levels, Fertilizers, Mustard, Seed

STANDARDIZATION OF GRAFTING TIME OF KINNOW MANDARIN UNDER NORTH WESTERN ZONE OF HARYANA

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Abstract: An investigation was carried out to standardize the suitable grafting time for Kinnow over rough lemon rootstocks during the years 2019, 2020 and 2021. The treatments consisting of four grafting date viz. 8th January, 22nd January, 6th February and 21st February. Scion collected from mother plants of Kinnow mandarin were grafted by wedge grafting method in open field nursery. The results showed that grafting dates significantly affected the days taken for sprouting, number of buds sprouted/ graft, sprouting, survival and final graft success. The highest graft success 71-76% was observed when wedge grafting was performed on 6th February followed by 49-62% on 21st February with considerable growth of saplings. However, leaf relative water contents and chlorophyll contents were found non-significant for time of wedge grafting. Therefore, the study revealed that 1st fortnight of February is the most suitable time of wedge grafting in Kinnow over rough lemon rootstocks under north western agro climatic zone of Haryana (India)

Keywords: Kinnow, Rough lemon, Wedge grafting, Graft success, Growth, RWC, Chlorophyll

ISOLATION AND CHARACTERIZATION OF ANTAGONISTIC RHIZOSPHERIC BACTERIA FROM LENTIL

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Abstract: Sixteen lentil rhizobacteria were isolated at nutrient agar medium. Out of which, twelve isolates showed antagonistic activity against *Fusarium oxysporum* f.sp. *lentis*. All the antagonistic isolates produced diffusible and volatile antifungal metabolites. The isolates 10 and 14 showed a maximum antagonism 72% and 68.6% respectively. All the antagonistic isolates showed PGPR activity such as phosphate solubilization, IAA production and ammonia production. Isolates produced IAA ranging from 1.25 to 3.61 µg/ml. The highest amount of IAA was produced by isolate 14.

Keywords: Antagonistic activity, PGPR, *Fusarium oxysporum* f. sp. *lentis*, PGP traits

ECONOMICS OF VARIOUS TREATMENT OF BIO STIMULANT ON THE YIELD OF SWEET POTATO

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Abstract: Bio stimulants are important biological or microorganism origin substances which is intended to use for increase plant nutrient use efficiency and growth process. It is used as organic fertilizer and substitute for synthetic fertilizers. Therefore, to analyse the effect of different bio stimulants on yield and quality of sweet potato, an experiment entitled “Effect of biostimulants on growth, yield and quality of sweet potato (*Ipomoea batatas* L.) cv. CO-34” was conducted at the vegetable farm, Department of Vegetable Science, College of Horticulture and Forestry, Jhalawar during *rabi* season 2020-21. The experiment consisted of twelve treatment combinations having four levels each of humic acid (0, 10, 20 and 30 ml/l) and seaweed (0, 1 and 2 ml/l) in Factorial Randomized Block Design with three replications. There was significant effect of biostimulants (humic acid and seaweed) on growth, yield and quality of sweet potato alone and combination over control. Significant increase in net return (Rs. 225039.30 / ha) and B:C (4.22) ratio was obtained with treatment T₁₁ (Humic acid 30 ml/l and seaweed 2 ml/l).

Keywords: Bio stimulants, Economics attributes, Humic acid, Sea weed, Sweet potato

VARIABILITY IN SEED TRAITS AND CHLOROPHYLL SPECTRUM OF EXOTIC BAMBARA NUT GERMPLASM

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Abstract: The Bambara groundnut [*Vigna subterranea* (L.) Verdc.] is an underutilized nutrient rich legume crop. This crop is widely cultivated in Africa and Asia. It is mainly grown by poor farmers in semi-arid parts of African countries. It is one

such imperative and neglected legume crop that contributes positively to improving global food and nutrient safety. It has great potential for incorporation into various human foods in India, where it could provide useful plant proteins. Variability in seed morphological traits were carried out on exotic bambara nut germplasm (33) imported from four African countries viz., Ghana, Niger, Tanzania and Uganda and as to group and identify unique germplasm based on seed traits and total chlorophyll content of germplasm. Twenty seed colour morphotypes in bambara nut were identified in the present study. The promising lines for seed traits were also presented.

Keywords: Bambara nut, Seed morphology, Seed colour, Chlorophyll content

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EVALUATION OF FUNGICIDES AS SEED TREATMENT ON DOMINANT SEED MYCOFLORA OF CHILLI VAR. GVC 101 *IN VITRO*

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Abstract: *In vitro* study was carried out to check the efficacy of seed treatment by fungicides on the seed germination and seedling vigour by controlling the most dominant seed mycoflora of chilli variety GVC 101 was carried out by paper towel method. Seed treatment with carbendazim + mancozeb @ 2.50g/kg seeds found most effective with significantly higher seed germination and seed health parameters for GVC 101 seeds pretreated with *A. niger*. Seed treatment with metalaxyl + mancozeb @ 3.50g/kg seeds found most effective with significantly higher seed germination and seed health parameters for GVC 101 seeds pretreated with *Colletotrichum* sp. Whereas, in seeds pretreated with *Fusarium* sp., significantly higher seed germination and seed health parameters were recorded in seed treatment with metalaxyl + mancozeb @ 3.50g/kg seeds for GVC 101. Captan and metalaxyl + mancozeb were found very effective in controlling or inhibiting the growth of most dominant seed infecting fungi of chilli. It was also noticed that all the seeds treated with tebuconazole @ 1.5g/kg seeds resulted in cent per cent inhibition in seed germination. This indicates toxic effect of tebuconazole @ 1.5g/kg seeds and at higher dose on chilli seeds.

Keywords: *A. niger*, Chilli, *Colletotrichum* sp., *Fusarium* sp., Seed germination, Seed mycoflora

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IMPACT OF APPLICATION OF SEWAGE WATER ON SOIL PHYSICAL PROPERTIES OF HARYANA

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Abstract: Nowadays, the water demand has increased considerably due to the increasing population, resulting in domestic sewage water. Due to the constraint in freshwater availability for irrigation, sewage water is being used for irrigation of agriculture fields. A survey was undertaken during 2019-20 and 2020-21 to study the physical properties of sewage water irrigated soils in different locations of Haryana, namely Karnal, Panipat and Hisar. Soil samples were collected at depths of 0-15, 15-30 and 30-45 cm from sewage and non-sewage irrigated fields. In this study, it was found that sewage water application improves the physical properties like bulk density, infiltration rate and field capacity of the soil compared to non-sewage water. All the physical properties except texture varied according to the composition of the sewage water and irrigation duration. The mean value of bulk density was reduced (1.35 Mg m^{-3}) in the soils irrigated with sewage water compared to non-sewage water (1.38 Mg m^{-3}). The mean value of infiltration rate under the study decreased (20.83 mm h^{-1}) with sewage water as compared to non-sewage water (23.60 mm h^{-1}). The available water content at field capacity of the soils irrigated with sewage water was found to be higher (18.49%) as compared to the soils irrigated with non-sewage

water(17.51%). The overall result is that use of the sewage water improves the physical properties of the soil as compared to the application of non-sewage water.

Keywords: Available water content, Bulk density, Infiltration rate, Sewage water, Texture

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NUTRIENT, YIELD AND ECONOMICS OF FENUGREEK INFLUENCED BY PHOSPHORUS AND CUTTING MANAGEMENT CV. PUSA EARLY BUNCHING

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Abstract: A field experiment on “Effect of phosphorus levels and cutting management on growth and yield of fenugreek under North Gujarat conditions” was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* 2020-21 on loamy sand. Nine treatment combinations comprising three levels each of phosphorus (50,100 and 150% RDP) and sources of cutting management (no cutting, cutting at 60 DAS and 85 DAS as leafy vegetable + seed production) laid out in randomized block design (factorial) with four replications. Results showed that 150 % RDP (60 kg P₂O₅/ha) and no cutting – only seed production gave significantly higher nitrogen, phosphorus content and uptake, seed yield, haulm yield while green leaf yield was highest in 150 % RDP (60 kg P₂O₅/ha) and cutting management at 85 DAS as leafy vegetable + seed production as well as net return and BCR was maximum at 150 % RDP and cutting at 60 DAS as leafy vegetable + seed production.

Keywords: Economics, Growth, Nutrient, Phosphorus, Treatment