Development and Evaluation of Tribo-aero- electrostatic for Impurity Separation from Plant Seeds (Flixweed)

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ABSTRACT

Seed purification is one of the important agricultural processes to obtain high quality seeds. Using modern technologies help producers to do this process with higher precision and accuracy. In order to separate seed impurities, a separation machine called Tribo-aero-electrostatic separator was designed. The machine was evaluated by separating the impurities prevailent in Flixweed (*Descuriania Sophia*). Primary laboratory tests revealed its high efficiency. Initial materials were separated in tribo-charge part through gravity and electrostatic force produced by high DC voltage. To evaluate the system performance statistically, the effects of voltage at three levels of 20, 30 and 40 kV, distance between the tribo-charge electrodes at three levels of 9, 15 and 21 cm and electrode angle of separation unit within three levels of 20, 30 and 40 degrees repeated in three replications with due regard to the weight of separation boxes. This experiment was performed as a CRD- based factorial design with the data analyzed using SAS software. The results indicated that the effects of all factors on the weight of purified seed and impurities in collecting boxes were significant at a 1% level of confidence. In addition, interactions of almost all factors in the collecting boxes (except the interaction between voltage and distance and also between voltage and angle in impurities, box) were significant at 1% level. By increasing the applied voltage and electrode angle, along with decreasing the electrode distance, the most suitable seed purity along with the highest quality was obtained in the pure seed box and while the maximum volume of impurities(qualitatively and quantitatively) were collected in the impurities 'box.

Keywords: Tribo-aero-electrostatic, electrode angle, electrode distance, electric field, high voltage.

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Design, Construction and Evaluation of a Sizing Machine for Hazelnuts

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ABSTRACT

Regarding the importance of sizing and grading crops for marketing and as well as processing operations, a machine was designed, constructed, and evaluated for hazelnut sizing. The machine design was based on sizing mechanism of diverged belt type. The sizing unit benefits from a structure similar to a horizontal belt conveyor, where instead of the belt; a continuous endless rope is divertingly wrapped around the driven and driving roller grooves. The distance between the ropes at the entrance of the input product (the end of the driven roller) is small becoming gradually larger to the other end of the drive roller. Hazelnuts are continuously fed into the sizing unit through the feeding unit that consists of a hopper and an inclined conveyor. Hazelnuts along the sizing path based on the size discharged on the tray with the output being led to the drain. In this plan, hazelnut is sized as based on the smallest diameter in the three sizes as small (less than 14 mm), medium (greater than 14 mm and less than 16 mm) and large (greater than 16 mm). The evaluation results indicated that the linear velocity and the class size significantly affected on the performance of the machine. The most appropriate linear rope speed was determined as 0.8 m/sec. Sizing machine efficiency for medium-sized nuts is highest and at about 92%. The overall efficiency of 84% was estimated for the machine.

Keywords: Sorting, Grading, Diverged belt, Hazelnut.

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Investigation of Vacuum Planter Performance Based on Video Processing and Kalman Filter

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ABSTRACT

The most widely used machine for precision sowing of cucumber and sorghum seeds is considered as the vacuum type. The performance and distribution accuracy of the vacuum type metering unit is of great importance. Therefore, the experiments at three pressures of 25, 35, 45 mbar and two levels of forward speed in the ranges of 3 to 4.5 km/h and 6 to 8.5 km/h were conducted and multiple planting, feeding quality and miss planting determined. In the meantime, a motion model is constructed using Kalman filter to track and draw the seed trajectories. Based on the analysis of seeds falling trajectories, it was found that there was a close relationship between seeds' falling trajectories and uniformity of seeding. The optimum levels of vacuum pressure and forward speed for precision seeding were found to be 35 mbar, 3 to 4.5 km/h, and 35 mbar, 3 to 4.5 km/h for cucumber and sorghum seeds, respectively. Finally, it was perceived that with increase in forward speed at inappropriate vacuum pressure, percentage of deviated seeds from a straight movement was increased, which caused decrease of seed distribution uniformity.

Keywords: Kalman Filter, Video processing, Pneumatic planter, Seed distribution uniformity

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Decreasing The Destructive Environmental Effects by Improving Efficiency of Sugar Beet Production Using Data Envelopment Analysis Approach

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ABSTRACT

Environmental impact assessment is an important factor in the approach towards sustainable development. Study, throughout the present the environmental impact of sugar beet production has been investigated. Data envelopment analysis was also applied to detect efficient units and to decrease the harmful environmental impacts. The final environmental index of impact category here consisting of global warming, acidification, eutrophication, depletion of fossil as well as water resources were recorded 0.138, 2.359, 2.055, 0.191 and 2.970, respectively. Based on the obtained results, depletion of water resources presented the greatest environmental impact. Global warming from among other impact groups presented the minimal environmental impact. Data envelopment analysis can lead to decrease the burden initiated from these impacts through conversion of the present farms to target units. Results demonstrated that CCR model diminishes impact categories more than BCC model does.

Keywords: Life cycle assessment, Global warming, Acidification, Depletion of resources, Hamadan

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An Investigation of the Vibration Transmissibility from Chainsaw Handle to Wrist and Arm of the Operator

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(Accepted: Aug. 16 - 2015- Received: Feb. 9, 2016)

ABSTRACT

Hand-arm vibration can cause vascular, neurological and musculoskeletal disorders, collectively named as hand-arm vibration syndrome. Chainsaw is a portable machine that exposes its operators to high levels of hand-arm vibrations. This research focuses on vibration transmissibility from chainsaw handle to wrist and arm of the operator. The vibration acceleration signals necessary for evaluation were obtained in an experiment using a Stihl-MS230 chainsaw in three positions (the front handle of chain saw, the wrist and arm of operator), in lateral, longitudinal, and vertical directions. Tests were performed at three levels of engine speed (2800, 10000, and 13300 RPM). The results indicated that the effects of speed, axis, and the interaction between the two on the RMS were significant at 1% level. The vibrations were damped during transfer process from handle to hand and arm by organs of the operator's body. Vibrations in high speeds were better damped than those for low speeds. A maximum value of vibration transmissibility from handle to wrist occurred in engine speed of 2800 RPM.

Keywords: Chainsaw, Hand- arm vibration, 1/3octave bands, Root Mean Square

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Measurement of Required Force to Separate the Grain from Paddy for Head Design of Rice Harvesting

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ABSTRACT

Through the present study, the tensile force required, to separate the grain from paddy was measured. The velocities related to separation of grain from paddy were chosen 100, 200, 300, 400, and 500 mm/min, and the force required for failure of stem at 100, 300, and 500 mm/min velocities were determined through application of an Intron device. The data were analyzed through a completely randomized design. The results showed that velocity significantly affected the required force to separate the grain from paddy as well as failure of stem. With an increase in tensile velocity from 100 to 500 mm/min, the required force to separate the grain from paddy decreased from 4.77 to 1.09 N and the required force for failure of the stem decreased from 33.43 to 8.41N. Also, the normal stress acting upon the stem as a due requirement force to separate the grain was calculated. The ultimate stress (rupture stress) of stem (the required force for the stem yield) was calculated. Finally the safety factor for the tensile force applied to the stem to separate the seed from the stem at velocities of 100, 300 and 500 mm/min, were respectively calculated as 5.74, 6.03 and 6.45.

Keywords: Separation velocity, safety factor, tensile force.

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Assessment of MF285 Tractor Engine Vibrations Resulted from Different Combinations of Biodiesel as Fuel Using Response Surface Method

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ABSTRACT

MF285 tractor engine vibrations resulting from the use of different combinations of biodiesel, bioethanol VS diesel as fuel were studied. Engine vibrations in three directions, and within three engine speeds of: 1000, 1600 2000 rpm and ten fuel levels were evaluated. To investigate the influence of the studied parameters on engine vibration, a factorial experiment in a randomized complete block design, as well as response surface methodology were employed. The results revealed that vibrations caused by the use of different combinations of fuels were less than those caused by use of diesel fuel. The results also indicated that increase in biodiesel fuel significantly reduces the vibration and the vibration increases with increasing engine speed. The vibrations increased by increasing bioethanol up to 4% but then started to decrease. Following optimization, the most appropriate fuel in terms of the lowest engine vibration was $B_{25}E_6D_{69}$ as through Response Surface Methodology, but Statistical Analysis introduced $B_{25}E_4D_{71}$ as a most appropriate fuel. However, the use of 25 percent by volume of biodiesel the vibration of reduced the engine.

Keywords: bio-ethanol, diesel, engine vibration, bio-fuels, tractor

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A Comparison of MLP and RBF Neural Networks Performance for Estimation of Broiler Output Energy

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ABSTRACT

Proper energy management is one of the main factors of the efficient use of energy resources. A prediction of crop yield as based upon energy input can help farmers as well as policymakers to estimate the level of production. Required data for the present study were randomly collected from 70 broiler farms in North West of Iran. The input energies included human labour, machinery, fuel, feed and electricity while the energies produced considered as output variables. Multi-Layer Perceptron (MLP) and Radial Basis Function (RBF) neural networks were applied for prediction of output energies of broiler production. A comparison of the results obtained from the indices of the coefficient of determination (R^2), Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE) the performance of ANN-RBF model as more appropriate than ANN-MLP model. In an evaluation of the effects of inputs on outputs of the production, fossil fuel showed the highest sensitivity among the production inputs in either of the models.

Keywords: Energy management, Energy resources, Prediction, Sensitivity.

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Diagnosis of Sick Ducks as Based on Their Voices and through Artificial Intelligence Methods

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ABSTRACT

In the present paper, a smart method is designed to classify healthy vs. from illness suffering ducks through the emission of their voices. Initially, the birds (based upon their health conditions) were divided into different categories with their voices being saved using a microphone along with data acquisition cards. Gained signals were transformed from time-domain signal to frequency domain, applying Fast Fourier Transform (FFT). Then, 5 statistical features were extracted from both time and frequency signals, namely, mean standard division, root mean square, variance and kurtosis. Two classifiers which are Artificial Neural Network (ANN) and Support Vector Machine (SVM) are used, to acquire the birds classified in healthy VS sick conditions. The accuracy of ANN classifier, in detection of healthy birds, within sick VS weak birds was respectively determined as 75% VS 82.1 % as based on the time and frequency domain of the sound signals. The accuracy of SVM classifier in detection of healthy birds within sick and weak birds was respectively determined 85.7 % and 92.8 % as based on the time and frequency domain of the sound signals.

Keywords: Sick birds detection, sound signals, data mining, Artificial Neural Network (ANN), Support Vector Machine (SVM).

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Effects of Hot Air Drying Method on Hypericin Extracted from *Hypericum perforatum* L. Leaves

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ABSTRACT

Drying is considered as one of the important stages of plant's postharvest operations which play an important role in maintaining the quantity and quality of their active constituents as well as ingredients. In this research, the effect of three treatments comprised of temperature at three levels of 40, 50 and 60°C, air velocity at two levels of 0.3 and 1 m/s along with the bed depth at two levels of 1 and 2cm were investigated to evaluate the effect on extraction of hypericin. Considering the results the highest level of hypericin was obtained during the drying process at 50°C and in a hot air velocity of 1 m/s within the bed depth of 1cm, amounting to 865.41 µg/g dry weight while the lowest was obtained during the drying process at a temperature of 60°C and the hot air velocity of 0.3 m/s within the bed depth of 2 cm amounting to of 587.31 µg/g dry weight.

Keywords: Drying, Hypericin, St. John's wort, *Hypericum perforatum* L.

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Development, Laboratory and Field Testings of a Bolling Probe for Measuring Stress in Soil

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ABSTRACT

Throughout the present study, a cylindrical Bolling probe was developed and evaluated for measuring stress in soil under tire traffic. The probe consists of a silicon rubber head for sensing the soil stress, a PVC tube for transferring the liquid pressure, a digital pressure sensor as well as a syringe for filling the probe with water and adjusting the initial inclusion pressure. A tank equipped with pressurized air was employed for laboratory testing of the probe. The probe head was inserted into the tank and following the sealing of the slits, the probe was tested at four initial inclusion pressures of 25, 50, 75 and 100 kPa. The relationship between Bolling and air pressures was investigated. The results indicated perfect linear relationships between the air and Bolling pressures at the different initial inclusion pressures. The difference between the Bolling pressure and initial inclusion pressure versus air pressure slightly (<5%) deviated from 1:1 line. Field testing of three Bolling probes at 15, 30 and 45 cm depth in wheeling experiments with tractor and combine harvester showed a satisfactory evaluation of stress variations with depth.

Keywords: Traffic, Tire, Stress, Soil compaction, Bolling probe.

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A Study of Drying Rate of Sliced Potatoes during Radiation-Vacuum Drying Process using Regression and Artificial Neural Network Models

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ABSTRACT

In this study, a single layer of sliced potato was dried using an infrared lamp heating under vacuum over three levels of radiant power namely: 100, 150 and 200 W, three slice thicknesses of 1, 2 and 3 mm, and the absolute pressure of 20, 80, 140 and 760 mmHg. Samples were dried in triplicate to achieve 6% moisture content (wet basis) which is suitable for long-term storage. Drying rate was monitored during the experiments. The shrinkage of sliced potato was recorded using image processing. The results indicated that increasing infrared radiation and reducing absolute pressure at the same slice thickness, could cause drying time to be reduced but resulted in increased shrinkage. Thickness of the slices and infrared radiation power rendered significant impacts ($P<0.01$) on shrinkage. Results also indicated that the Neural Network model ($R^2=0.9732$) predicted drying time more accurate than either linear ($R^2=0.819$) or nonlinear ($R^2=0.870$) Regression Models.

Keywords: Drying Time, Shrinkage, Image Processing, Artificial Neural Network, Regression Model

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Rough Rice Stress Fissuring as Affected by the Conditions of Drying and Tempering Processes

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ABSTRACT

Throughout the present study, the efficacy of intermittent as well as continuous drying processes on fissuring of Hashemi and Koohsar varieties was investigated. The fissuring of the kernels was assessed as based on Stress Cracking Index (SCI). The experiments were carried out at drying and tempering temperatures of 30, 45 and 60 °C, drying durations of 20, 40 and 60 min, and a constant tempering duration of 80 min. In comparison with continuous drying method, under intermittent drying method, SCI value reduced significantly from 43.5 to 17; 74.5 to 28.3, and from 83 to 58.4, respectively at temperatures of 30, 45 and 60 °C. Also, the value of SCI measured 48 h following the drying process being finished, compared with its corresponding value measured immediately after drying operation increased significantly from 28.72 to 46.73. Both the total operation time (sum of all passes durations) and SCI decreased as tempering temperature increased, due to the faster elimination of moisture gradients inside the kernels. Therefore, by appropriate tempering operation, in addition to maintaining the quality of the final product, the total operation time too, could be reduced.

Keywords: Intermittent drying, moisture gradient, stress cracking index, variety.

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Development and Laboratory Evaluation of a Mixed Planting Machine for Corn and Bean

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ABSTRACT

One of the main problems involved in mixed culture is the use of proper agricultural machines for planting two or more crops simultaneously. In the present study in order to diminish the difficulties of using agricultural machinery in the planting operation stage of corn and bean simultaneously, a planter was designed and developed to promote planting of two different types of seeds of different shapes and sizes in their precise proportions and different planting patterns while employing the correct principles of mixed culture. For evaluation of the mixed planting machine, the tests were done in a completely randomized design of 5 different distances between seeds (5.5, 8.5, 11, 13 and 16 cm) for corn planting unit and 5 different distances between seeds (10, 12, 15, 18.5 and 21.5 cm) for bean planting unit at the constant speed of 4 kmh^{-1} carried out in three replications. Throughout the present research, the multiple indexes, miss index, precision index and quality of feed index were taken into consideration. Results of corn and bean planting unit as obtained in laboratory evaluation showed that, in line with increasing the distance between seeds on the planting lines, multiple, miss and precision indexes were decreased, while the quality of feed index was increased. These situations for corn planting unit in laboratory evaluation was observed in 16 cm of distance between seeds and for bean planting unit it was observed in 21.5 cm distance between seeds.

Keywords: Bean, Corn, Planting, Precision index, Quality of feed index

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Neuro-fuzzy and Response Surface Modeling of Osmotic Dehydration of Pomegranate Arils

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ABSTRACT

Pomegranate arils were dehydrated through osmotic dehydration in 40, 50, and 60 % sucrose solution and at 45, 55 and 65 °C. Weight reduction, solid grains and water loss of the products were evaluated after 60, 120 and 180 minutes past of the process. Osmotic dehydration processes were modeled by a combination of neural network and fuzzy logic technique (Neuro-fuzzy) along with response surface methodology. For modeling, interpolation and increase of the data, fuzzy logic was employed through an insertion of the obtained results from fuzzy model into the neural network tool, the Feed-Forward-Back-Propagation network with the topology of 3-8-3 and the correlation coefficient of 0.98344 and mean square error of 0.02278 with application of Log-sigmoid transfer function (logsig). Levenberg–Marquardt learning algorithm was determined as the most appropriate neural model. Regression models created by response surface methodology (by correlation coefficient of 0.90) were also capable of the prediction of the response factors, but in comparison with Neuro-fuzzy models, they were of a lower level of accuracy.

Keywords: Modeling, Neural Network, Fuzzy Logic, Response surface, Pomegranate arils

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Effect of Acid Extraction Conditions on Yield and Quality Characteristics of Pectin Extracted from Sour Orange Peel

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ABSTRACT

Sour orange is one amongst the native fruits to Iran, widely used in food industry, as well as in medicine and cosmetics. Sour orange peel is a rich source of pectin, but mostly discarded as waste. Throughout the present research, Response Surface Methodology (RSM) of Box–Behnken design was employed to study, and optimizes the effects of some of the independent variables (temperature, time and pH) on the yield and as well on the degree of esterification of pectin extracted. The percentage of galacturonic acid, emulsifying properties, the viscosity and FT-IR spectra of the pectin were compared with those determined in optimal conditions. The results showed, extraction efficiency, and the degree of esterification of pectin extracted within various conditions is varied within the ranges of 5-27.5 and 6.6-46.5, respectively. The highest yield pertaining to pectin (28.78) was obtained at a temperature of 95°C, within duration of 90 min and pH of 1.5. Pectin extracted in optimal conditions was of a degree of esterification of 24.6%, yield of galacturonic acid of 75.5%, emulsifying activity of 45.6% and suitable emulsion stability. As well, the flow behavior is observed Newtonian in low concentrations (≤ 1 %w/v), but behavior is changed (with increasing concentration) from Newtonian to pseudoplastic.

Keywords: Pectin, Sour orange peel, Degree of esterification, Emulsion, Viscosity

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Design, Development and Evaluation of an Electronic Control Valve for the Hydraulic Pump of MF 285 Tractor

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ABSTRACT

The depth control systems employed in Iran made tractors are of mechanical type, producing varied tillage depths in fields, especially those of uneven surfaces. Throughout the present research, a rotary type electronic control valve was designed and constructed. By using this valve, electro-hydraulic tillage depth control system was developed and installed on the tractor. The control system was composed of: a depth sensor, a Programmable Logic Controller (PLC), a stepper motor with deriver, a control valve and a Programmable Terminal (control panel). The tillage depth was estimated by utilizing a depth sensor and the control valve which is controlled by the stepper motor was used to 3-point linkage control. The laboratory results showed that the depth variations were well controlled by the developed system within ±2 cm in the steady state. Also the field data indicated that the mean tillage depth of electro-hydraulic depth control system was greater than that of the mechanical depth control system with significance difference.

Keywords: Electro-hydraulic, Tillage, Depth control, PLC, Stepper motor

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Possibility of Crop Density Estimation System through Optical Feasibility Method

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ABSTRACT

Provision of food for the growing world population has become an important universal issue throughout the whole world. So, to make changes in farming methods to conserve the natural resources and to increase production has become a necessity. One of the main issues of precision agriculture is precision in harvesting. In order to increase a farm harvest machine's performance, to submit a continuing volume of mass to the system is indispensable. Throughout the present study, the feasibility of estimating wheat density was investigated by using a non-destructive method of output voltage of the light received by the photovoltaic cells. For the static tests, treatments and procedures, a system was designed and built. An experiment with different densities on the wheat crop was carried out. With the components of optical system clouding: photocells, LED lights and plates involved. To evaluate the effects of variables, a randomized block design with factorial treatment arrangement was employed. For the optical method, the independent variables including number of stems per unit area (300, 350 and 400), plates distance (12, 21 and 30 cm), light intensity of LED lamps (274 Lux and 21.2 Lux) and testing time (afternoon vs. night). All experiments were performed in triplicates. The results showed that, testing time and light intensity had greater effect on the voltage value. These results can be used to build a system set on the harvest machine. With the help of this system installed on the front part of the platform of a grain combine the harvester's product density can be estimated.

Keywords: Density estimation; Photocell; Capacitance plates; Light wheat; Harvest machine

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GHG Emissions Footprint from Potential Feedstock Production of Biodiesel Fuel (Case Study)

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ABSTRACT

Population growth followed by increasing industrial as well as agricultural growth activities bring about increase in GHG emissions and make risk from environmental management to be a serious challenge. Therefore, attending to the renewable and clean energy has become a point of increased interest. In this regard, and for the potential feedstock production of fuels, requires the use of inputs with non-potential environmental pollution. Thus, in this research, the GHG emissions footprint from peanut production as a potential feedstock for biodiesel fuel was investigated. Data were collected through interviews with 75 peanut farmers. The cultivated areas were divided into three categories, based on the size of peanut farms as 0.1–0.5 ha, 0.5-1 ha and larger than 1 ha. The results revealed that total GHG emissions of peanut production were obtained 822.29 kg CO2eq ha-1. The highest share of GHG emissions belonged to diesel fuel (57.90%) followed by machinery (18.6%).The mean difference between total GHG emissions per unit area among farm sizes including 0.1–0.5 ha and larger than 1 ha was significant at 5% level. Larger farms from 1 ha carried a minimum level of GHG emissions. Also, GHG emissions from peanut production as a potential feedstock for one liter of biodiesel fuel production were estimated as 1.17 kgCO2eqha-1.

Keywords: Environmental impacts, Clean fuel, Farm size, Peanut

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Design, Construction and Performance Simulation of a Novel Helical Manure Distributor Machine

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ABSTRACT

Organic manure plays its important role in the improvement of soil through decrease in bulk density, increasing porosity as well as water infiltration rate. However, the method of manure spreading influences its beneficial impact on soil structure and as well texture. In this study, a novel helical manure distributor mechanism, capable of spreading manure of different moisture contents at its maximum distribution width, was developed and the performance of the machine modeled. The machine consisted of two helical screw conveyors placed at the bottom of the hopper. Grips spirally mounted at the middle of the auger's shaft transferred manure to the distribution unit. Manure distribution system included two drums one at the end side of the hopper. Manure was broadcasted through centrifugal force applied by the rotational motion of the drums. The effects of the drums speed and manure particle size and mass on distribution width were studied. Power requirement of the augers was calculated at different rotational speeds of the auger and within three levels of the internal friction of manure. In addition, power requirements of the drums were computed at different rotational speeds. The distribution width and volume of the hopper were 14 m and 6 m^3, respectively. The discharge flow rate of the machine varied from 0.022 to 0.073 m^3/s .The results revealed that PTO power requirement increased by increase in the rotational speed and internal friction of the manure. Maximum PTO power and drawbar power requirements of the machine were determined to be 34.2 and 18.45 hp, respectively.

Keywords: Auger (screw conveyor), Manure, Distribution width, Performance simulation

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