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SMALL SCALE CONSTRUCTED WETLAND UNITS FOR DOMESTIC GREYWATER TREATMENT

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Constructed wetlands (CWs) are widely used environmental friendly greywater treatment method. However, requirement of larger land area is a major limitation for its use. Small scale CW units can be the best option for domestic greywater treatment since it reserves limited land area. This study aimed to check the feasibility of using small scale CW units for domestic wastewater treatment. The CW units were constructed using plastic containers (55x30x30 cm). Eight treatments; in combination of selected wetland plants Vetiver (*Vetivria zizanioides)*, *Kangkung (Ipomoea aquatica)*, *Kohila (Lasia spinosa)* were tested and soil without amendments were served as a control. Wastewater were synthesized, similar to the domestic greywater and fed into CW units at the rate of $0.5 \, l \, h^{-1}$. Hydraulic retention time was 63 hours. Phosphate Phosphorous (PO_4^{-3}-P), Nitrate Nitrogen (NO_3^--N), Ammonium Nitrogen (NH_4^+-N), Total Dissolve Solids (TDS), pH, Electrical Conductivity (EC) and certain trace elements were monitored both in influent and effluent in two week intervals for two months. The experiment was conducted in a completely randomized design with three replicates. Results revealed that each combination of wetland plants recorded an increasing pollutant (NH_4^+-N, $NO3^-$-N, PO_4^{-3}-P, TDS, pH, EC and trace elements) removal efficiencies (REs) throughout the monitoring period. Plant combination of *Kangkung, Kohila* and Vetiver showed significantly ($p<0.05$) higher performance in removal of NH_4^+-N, NO_3^--N, PO_4^{-3}-P with the REs of 62%, 66% and 65% respectively. After the treatment process; in all treatments, trace elements, pH, EC and TDS of the effluents were ranged around the permissible level following the general standards for wastewater. The overall results conclude that small scale CW units are a viable technology for greywater treatment at domestic level with the combination of *Kangkung, Kohila* and Vetiver. Further studies are recommended for concrete conclusion.

Keywords: Constructed wetlands, Greywater treatment, Removal efficiencies, Wetland plants

THE IMPACT OF WATER QAULITY ON TASTE PROFILE OF MADE TEA IN SRI LANKA

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Type of water used for brewing tea make a difference in taste profile of made tea, color and, aroma despite of tea with same quality. Hence, quality of water plays a major role in making tea infusions. This study was conducted to determine the influence of water quality on the taste profile of made tea. Water samples were collected from most commonly used potable water sources in Sri Lanka, i.e. well water from selected locations (*Nikaweratiya*, *Matale*, *Anuradhapura*, *Kebithigollewa*), RO filtered water, tap water and mineral water. Distilled water was used as the control. Hardness, pH, Total Alkalinity, PO_4^{-3} -P, Cl^-, F^-, NO_3^-, Total Dissolved Solid (TDS), and Dissolved Oxygen of each water source were tested. Then infusions of black tea, green tea and flavored tea were prepared and the sensory evaluation was performed according to the ISO 3103-1980 standards by a standard tasting panel. Data were analyzed using SAS 9.0 software. According to the results, highest overall acceptability for black tea was recorded for the infusions made from distilled water, *Kabithigollewa* well water and RO filtered water. These water samples reported lower values of TDS, Cl^-, and hardness among the other water sources. Highest overall acceptance for flavored tea and green tea was recorded from mineral water attributed to moderate values for almost all the measured water quality parameters. However, the worst taste profile was reported for all three types of tea infusions made by using well water from *Anuradhapura*. Hardness, alkalinity, TDS, Cl^- and F^- contents of water samples collected from *Anuradhapura* were reported highest values compared to others. Therefore, this study concludes that the quality of water is significantly affecting on the taste profile of tea intrusions and further studies are recommended with water samples from all over the island to test its impacts on the tea taste.

Keywords: Sensory evaluation, Taste profile, Tea, Water quality

EFFECT OF AERATION ON PRODUCTION RATE AND NUTRITIONAL LEVEL OF ENRICHED COMPOST

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Agricultural activities tend to generate a substantial volume of animal and crop residues. Composting is the most economical and ecologically sustainable option to manage farmyard waste. However, it takes approximately three months to complete decomposition and contains lower plant nutrients percentage compared to inorganic fertilizers. This study aimed to reduce the decomposition time and improve nutrients content of compost. Aerobic decomposition was enhanced by aeration inside the pile using a blower with 0.5 $Lmin^{-1}kg^{-1}$ air flow. Paddy straw, poultry manure, goat manure, cattle manure, and paddy husk ash were mixed in 3:1:1:1:1 ratio respectively as the raw materials and 3% of *Eppawala* rock phosphate was added to the mixture in weight basis. Six piles; (150x100x80 cm) were prepared and 3 piles were aerated for six hours per day. Other 3 piles were left to decompose under ambient condition as the controls. According to the results, aerated and control piles took 35 days and 65 days respectively to complete the decomposition. Total N, available P, exchangeable K, C/N ratio, pH, EC, and (Cation Exchange Capacity) CEC were analysed in compost samples from aerated (after 35 days) and controls, and the results were, 20.5 gkg^{-1}, 1.8 gkg^{-1}, 10.4 gkg^{-1}, 7, 8.8, 4.3 $mScm^{-1}$, 19.3 $cmolkg^{-1}$ and 17.8 gkg^{-1}, 1.5 gkg^{-1}, 9.9 gkg^{-1}, 8.5, 8.8, 3.64 $mScm^{-1}$, 21.3 $cmolkg^{-1}$ respectively. Data were analysed using SAS 9.0 software with 95% confidence interval. The results revealed that, there is a significant increment in total N, exchangeable K, C/N ratio, EC, and CEC in aerated piles compared to controls. And the nutrient composition of both methods were significantly higher than commercial compost. Therefore, it can be concluded that, decomposition time can be effectively reduced and nutrient level can be increased by artificial aeration and nutrient enrichment respectively. However, further studies are recommended to study the economic feasibility.

Keywords: Force air circulation, Enriched compost, Decomposition, Plant nutrients

DESIGN AND DEVELOPMENT OF A TWO-WHEEL TRACTOR COUPLED BUND PLASTERING AND CANAL (*kiwul-ela*) MAKING EQUIPMENT

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Rice (*Oryza sativa* L.) is the staple food and major crop in Sri Lanka. Improving rice cropping practices and production systems are required to enable a sustainability. Presently bund cleaning, plastering, and *kiwul-ela* constructing are done manually and there is no proper mechanical solution. Thus, this study was aimed to design and develop an appropriate bund plastering and *kiwul-ela* making equipment as a rear attachment to a walking type two-wheel tractor. Design, fabrication and testing were done in Faculty of Agriculture, Rajarata University of Sri Lanka. The main components of the equipment were bund plaster, bund cleaner, *kiwul-ela* maker, depth controller, and main frame. Mild steel box iron and sheets, galvanise pipe and rubber wheel were used to construct the prototype. Permanent and non-permanent fastening methods were used. The total weight, length and width of the equipment were 38.85 kg, 1.2 m and 0.92 m, respectively. The preliminary tests were conducted to evaluate the performance of the prototype and modified using the classical approach of farm machinery design and development. After primary land preparation, a low land puddle paddy field with an average bulk density of 2.144 gcm^{-3} and moisture content of 14.81% were used as the test field. The prototype showed significantly higher comparative performances; 93.93% of time saving and 64.4% of cost reduction over the manual method *(p<0.05)*. Further, prototype showed highly satisfactory field performances; operational speed 2.045 kmh^{-1}, draft force 49.08 N, plastering thickness 0.032 ± 0.002 m, and height 0.21 ± 0.02 m, theoretical field capacity 52.054×10^{-3} hah^{-1} and field efficiency 63.6%. Due to the higher performance of this bund cleaning, plastering and *kiwul-ela* making equipment, it could be recommended for paddy farmers. However, the plastering height could be further increased by modifying the mouldboard of this equipment.

Keywords: Bund cleaner, Bund plastering, *Kiwul-ela* making

DESIGN AND DEVELOPMENT OF A MULTI-CROP HOT-AIR SOLAR DRYER

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Appropriate technology for conversion of solar radiation to thermal energy is vital for food dehydration. Solar drying considered as an elaboration of sun drying, is an efficient system of utilizing solar energy. Reliable and low-cost multi-crop solar drying technique is required for small scale farmers in Sri Lanka. Therefore, the objective of this study was to design and develop a multi-crop hot-air solar dryer for small scale farmers. Design, fabrication, and testing were done in National Institute of Post Harvest Management, *Anuradhapura*. The main components of the equipment were flat plate solar collector, drying chamber, solar panel with air heater, turbo ventilator, exhaust fans, and temperature controller. Mild steel angle iron bars, blue iron sheets, plastic coted wire mesh, rigiform, aluminum foils, galvanized sheet, and rubber insulators were used to fabricate the prototype. Experiments were carried out to compare the open sun drying technique with multi-crop hot-air solar drying before and after installing the heater. Bitter gourd, jackfruit, and mushroom were the crops used in the experiment. The moisture removal rate of the solar dryer with heater for each crop was significantly higher than the other treatments ($p<0.05$). The moisture removal rate for bitter gourd, jackfruit, and mushroom after installing the heater conditions were 0.151 kgh^{-1} ± 0.001, 0.145 kgh^{-1} ± 0.004, 0.154 kgh^{-1} ± 0.003 simultaneously at 25.84% solar collector efficiency. Results indicated that the fabricated multi-crop hot air solar dryer is an effective method of conversion of solar radiation to thermal energy. Further improvements are required to increase the solar thermal efficiency of the multi-crop hot air solar dryer.

***Keywords*:** Hot-air drying, Multi-crop, Solar drying

ANALYSIS OF TRENDS IN STREAMFLOW AND ITS LINKAGE WITH RAINFALL IN *KELANI* RIVER USING INNOVATIVE TREND ANALYSIS APPROACH

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Assessment of hydro-climatic trends is useful in resource planning especially in river basin scale under climate variability and change. This study investigated the trends of streamflow in the *Kelani* river and its association with rainfall over 30 years period. Streamflow and rainfall were assessed at six and eight stations respectively using Innovative Trend Analysis (ITA) and Mann Kendall test (MK) with Sen's slope estimator. The relationship between streamflow and average catchment rainfall was tested using Spearman's rho correlation coefficient (ρ). Both ITA and MK tests confirmed the decreasing annual and seasonal streamflow trend from mid-stream to downstream of *Kelani* river basin. A decreasing trend of rainfall was recorded in 75% and 63% stations during South West Monsoon (SWM) and Second Inter-Monsoon (SIM) respectively. However, annual, North East Monsoon (NEM) and First Inter-Monsoon rainfall showed an increasing trend in 63%, 88%, and 100% stations respectively. Moreover, there was a positive correlation between the streamflow and catchment rainfall at all time scale tested. The maximum ρ was observed for annual streamflow at *Kithulgala* gauging station (ρ=0.61) and the minimum ρ was recorded at *Holombuwa* station (ρ=0.17) with respective catchment rainfall. There was a significant association between streamflow and catchment rainfall ($p<0.05$) for the tested time period for 70% of stations suggesting that the variation of streamflow is mainly attributed to the variation of catchment rainfall. The decreasing trend of streamflow and rainfall during SWM and SIM towards the downstream area with the increasing temperature trend indicate a drying tendency of *Kelani* river basin over the study period. The results of this study are useful in formulating a sustainable plan in the usage of water in *Kelani* river basin.

Keywords: Innovative trend analysis, *Kelani* river basin, Mann - Kendall test, Rainfall, Streamflow

DEVELOPMENT OF A PORTABLE, HEIGHT ADJUSTABLE, AND SAFE SMOKER FOR CHASING GIANT HONEYBEES (*Apis dorsta*)

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Giant honeybee *(Apis dorsta),* called *Bambara* in Sinhala has been pervaded all over the Sri Lanka. It lives in a colony of a large single vertical comb, which is built in underneath of rock cliffs, branch of trees, eaves of buildings, overhead water tanks and towers at height up to 50 meters. Although they tend to be aggressive if disturbed, they are considered to be one of the most important pollinators of the nature. Tourists, pilgrims, tea pluckers and school children are often the victims of *bambara* attacks. As a solution, colony is dispelled by using various harmful methods including burning. Use of smoke toward the colony and removal of the comb is a suitable technique to dislocate them. However, a safe and reliable mechanical smoking device is not available, therefore, this study aimed to introduce a portable, height adjustable, and safe smoker for chasing them in order to resettle in another place as they are very important. Smoker consists of smoke generation unit, smoke blowing unit, power supply unit, and smoke delivery unit. The volume of the smoke generation unit is 4 L and the height of the delivery unit can be adjusted up to 10 m. Straw and Guinea grass (1:1 ratio) were used as the firing material and performance of the smoker was tested with different compaction levels using five colonies. Firing time, air flow rate, and temperature of smoke were measured during each trial. Data were analysed by ANOVA using complete randomized design at ($p<0.05$). The suitable compaction level for the smoke generation unit was when it filled with 270 g of mixture. The firing time, smoke flow rate and the temperature of smoke at this level were recorded as 21 minutes, 18.5 Lmin^{-1} and 37 $^{\circ}$C respectively and it took only 8 minutes to clear the bees for easy removal of the comb. According to the performances the newly developed smoker could be recommended for chasing *bambara* bees colonies effectively and safely.

Keywords: Bambara bee, Giant honey bee, Smoker

DESIGN, DEVELOPMENT AND EVALUATION OF ANIMAL FEED BLOCK MAKING MACHINE

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The dairy industry is one of the most important industries in Sri Lanka. The present status of the dairy industry in Sri Lanka is far below expectations due to low productivity of dairy animals. Insufficient feedstuff due to the seasonal production variation is the major reason for low productivity. During dry periods, farmers can use agricultural by-products as a supplement which can be preserved as a feed block in order to supply feeds continuously. Unavailability of an affordable mechanical solution is a constraint to produce feed blocks for small scale farmers. Therefore, in this study, it was aimed to introduce an efficient and affordable feed block making machine for small scale level. The main components of the machine are hydraulically operated mold, movable piston and frame. The height, width and length of the machine were 150cm, 53cm, and 55cm respectively. The total material cost of the machine was about 35,000LKR. The evaluation of the developed machine and the produced feed blocks was done in terms of durability, post compression expansion, the time taken to optimum compaction, and the shelf life. Two mixtures of ingredients with paddy straw were used for the testing of feed blocks. The suitable compaction time for the mixture with 10% molasses and for the mixture with 5% molasses and 5% cement were 15 minutes and 10 minutes respectively at 4687 KN/m^2 pressure. The post compression expansion for mixtures were 18.64% and 23.73% respectively. The average weight of a block was 100 g and the volume of the block can be further increased by modifications. Any change in appearance, color, and odor of the feed blocks were not observed within 10 days of storage. According to the results it can be concluded that the machine is affordable and suitable to preserve the feedstuff as blocks.

Keywords: Durability, Feed block, Post compression expansion

VARIATION OF WATER QUALITY OF FOUR WATERSHED OUTLETS IN UPSTREAM OF *MAHAWALI* RIVER DURING *MAHA* CROPPING SEASON

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Agricultural land based water pollution has been identified as a main cause for environmental problems in Sri Lanka. Four micro watersheds, *Naranhinna*, *Kappeti-Ela, Rajamale,* and *Lagumdeniya* located in the *Kandy* district have been identified by the project on Rehabilitation of degraded agricultural lands in the Central Highlands implemented by Food and Agriculture Organization to rehabilitate through watershed management plan. Present study evaluated the baseline water quality status of these micro watersheds by taking water samples at the outlet of each watersheds during the *Maha* cropping seasons 2018/2019. Water samples were collected six times and analyzed for pH, EC, TDS, HCO_3^-, CO_3^{2-}, NO_3^-, NH_4^+, available P, total K, Na, Ca, Mg, Fe, Al, As, Cd, Hg, Cr, Mn, and Pb using standard methods. Most of the tested drinking water quality parameters in all four micro watersheds were within the permissible limits of WHO standard except Fe, and NH_4^+. Observed Fe content exceeded the WHO limits (0.3 mg/L) of all watersheds and was in the range of 1.2 – 1.5 mg/L. Concentration of $NH4^+$ at *Kappeti Ela, Rajamale,* and *Lagumdeniya* was in the range of 0.5 to 0.7 mg/L which exceeded the WHO standard (0.5 mg/L). This study calculated Drinking Water Quality Index (DWQI) and also Irrigation Water Quality Index (IWQI) for all investigated micro watersheds using the tested parameters. The water of all four micro watersheds can be graded as excellent in terms of DWQI and it varied from 14.7 to 31.03. Considering mean IWQI (35.2 – 52.6) of tested watersheds, the water can be characterized as good for any crops during the study period. However, it is suggested to monitor the water quality status of these four micro watersheds during low rainy *Yala* cropping season to further understand entire behavior of these four micro watersheds in relation to water quality.

Keywords: Drinking water quality index, Irrigation water quality index, Micro-watershed, Water quality

APPLICATION OF REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE) MODEL TO ASSESS SOIL EROSION IN '*KALU GANGA*' RIVER BASIN

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Soil erosion is one of the main forms of land degradation. Erosion contributes to loss of agricultural land productivity, ecological, and esthetic values of land and it impairs the production of safe drinking water and hydro energy production. Assessment of soil erosion is vital to identify the lands more prone to erosion. Revised Universal Soil Loss Equation (RUSLE) model supported by a geographical information system was used to assess the spatial variability of erosion occurring at *Kalu Ganga* river basin in Sri Lanka. This study used Digital Elevation Model (30 x 30 m), twenty years rainfall data measured at 11 rain gauge stations across the basin; land use and soil maps; and published literature as inputs to the model. The average annual soil loss in *Kalu Ganga* river basin varied from 0 to 134 t ha^{-1} year^{-1} and mean annual soil loss was estimated at 0.63 t ha^{-1} year^{-1}. Based on erosion estimates, the basin landscape was divided into three different erosion severity classes; low, moderate and high. About 1.68% of the areas (4713.92 ha) in the river basin were identified with moderate to high erosion severity (>5 t ha^{-1} year^{-1}) class which urgently need measures to control soil erosion. Lands with moderate to high soil erosion classes were mostly found in *Bulathsinghala*, *Kuruwita* and *Rathnapura* divisional secretarial divisions. Use of the erosion severity information coupled with basin wide individual RUSLE parameters can help to design land use management practices appropriate and improved management based on the observations, to minimize soil erosion in the basin.

Keywords: *Kalu Ganga* river basin, Revised Universal Soil Loss Equation, Soil erosion, Soil erosion hazard map

TREATMENT OF REVERSE OSMOSIS CONCENTRATE AND KITCHEN WASTEWATER BY PHYTOREMEDIATION TECHNIQUES

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Reverse Osmosis (RO) plants have been widely used in CKDu (Chronic Kidney Disease of unknown etiology) affected areas of the North Western Province as an effective drinking water treatment method. Wastewater released from RO plants concentrated with various contaminants presented in raw water is normally released to the environment without treatment. Constructed wetlands (CW) are low cost and effective technique in wastewater treatment. However, the use of CW in RO concentrate treatment is not much effective due to the availability of lower nutrient contents. Therefore, this study aimed to identify the potential of phytoremediation techniques to enhance the removal efficiency of pollutants in RO concentrate combined with kitchen wastewater. Four plant species; Vetiver (*Vertiveria zizaniodes*), Cattail (*Typha augustifolia*), Cannas (*Canna indica*) and Bulrush (*Scirpus maritimus L.*) were planted in plastic containers and soil without amendments was served as the control. RO concentrate from RO plant of the Faculty of Agriculture and synthesized domestic wastewater were fed in to the experimental pots for two months period at the rate of 0.6 Lh^{-1}. The hydraulic retention time was 42 hours. Water samples were collected from the inlets and outlets of each experiment unit by two week intervals and analyzed for pH, Electrical Conductivity, Total Dissolved Solids, concentration of Na^+, Ca^{2+}, Mg^{2+}, PO_4^{3-}-P, NH_4^+-N, NO_3^--N, Pb, As and Cd. The experiment was conducted in a Completely Randomized Design with three replicates. Removal efficiencies (RE) of all pollutants increased with time and Cannas and Bulrush plants showed higher pollutant removal. Cannas and Bulrush plants reported REs of 73%, 73%, 47% and 71%, 71%, 38% for PO_4^{3-}-P, NO_3^--N and NH_4^+-N respectively. Therefore it can be concluded that the pollutants in RO concentrate and kitchen wastewater can be efficiently removed by phytoremediation techniques. However further studies are required to identify the most effective plant species.

Keywords: Constructed wetlands, Phytoremediation, Removal efficiencies, RO concentrate

IMPACT OF DETERGENTS ON CHEMICAL, BIOLOGICAL AND PHYSICAL PROPERTIES OF ALFISOL IN *ANURADAPURA,* SRI LANKA

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Disposal of untreated laundry greywater into natural environment is a common practice in developing countries. Laundry greywater contains significant amount of detergents that can alter the soil properties. The objective of this study was to evaluate the characteristics of laundry grey water and evaluate its impacts on soil physical, chemical and biological parameters. Fifteen soil samples were collected from laundry grey water disposal sites of selected households in *Puliyankulama*, *Anuradapura*. Simultaneously, a reference soil sample was obtained from nearby locations of each sampling point which is not influenced by grey water. Soil samples were taken from 0-30 cm and 30-60 cm depths. Similarly, undisturbed soil core samples were collected from 0-30 cm depth. Grey water samples collected from each household were analyzed for TDS, pH, EC, NO_3^--N, PO_4^{3-}-P, Heavy Metals (As, Pb, Cd) and cations (Na, Mg, Ca, and K). Soil samples were analyzed for pH, EC, total N, PO_4^{3-}-P, Cd, As, Pb, Cation Exchange Capacity (CEC), Exchangeable Na, Mg, Ca, K, bulk density, biomass carbon and CO_2 evolution. Soil chemical, physical and biological properties of greywater contaminated sites and corresponding reference samples were compared by paired t test. Results indicate that, significantly ($p<0.05$) lower biomass carbon and CO_2 evolution were observed in top soil samples contaminated with laundry greywater compared to reference samples and significantly ($p<0.05$) higher pH, EC, Na, total N and available P were observed both in top and sub soil samples compared to reference samples. Moreover, CEC and Mg of topsoil in the samples were significantly ($p<0.05$) higher compared to reference samples. However, there were no significant ($p>0.05$) difference in bulk density, Mg in subsoil, K, Ca and heavy metals in top soil. This concludes that impact of detergents on soil chemical and biological parameters are significant compared to the physical parameters.

Keywords: Detergents, Laundry grey water, Soil parameters

ASSESSMENT OF METEOROLOGICAL DROUGHT OVER SRI LANKA USING STANDARDIZED PRECIPITATION INDEX

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Drought is one of the natural hazards which can cause huge damage to economic and social activities of human and ecosystem and is aggravated by climate change. Usually, meteorological drought precedes the other types of drought. Drought indices are vital elements for monitoring and assessment of drought and Standardized Precipitation Index (SPI) is the widely applied index to analyze meteorological drought for different time scales. In this study, drought events in Sri Lanka were assessed using SPI at 3, 6, and 12 months time scales using monthly rainfall during 1970-2017. The frequency of drought events was evaluated using SPI and trend of SPI was also detected by using the Innovative Trend Analysis (ITA) technique. The result based on SPI at annual time scale identified that hydrological years 1975-76, 1982-83, 1986-87, 1988-89, 2000-01, 2001-02, 2013-14, and 2016-17 as drought years for 52, 32, 35, 33, 33, 31, 31, and 31% of tested stations (54) respectively. The comparison of the SPI time scales discovered that more drought events (SPI≤-1) occurred in April-September time scale (*Yala* cropping season) than the 3, 6 (*Maha* cropping season), and 12 months time scales. Considering in Thiessen polygon average rainfall, more frequent drought events occurred in the dry zone (57%) than the wet (49%) and intermediate zone (47%) at the annual time scale. ITA results revealed that mild (0>SPI>-0.99) and heavier drought (SPI≤-1.5) events are in increasing trend at 80% and 56% stations in dry zone respectively while mild drought events are in increasing trend at 57% of stations in the intermediate zone. The results indicated that the dry zone in Sri Lanka was subjected more to drought and is having an increasing tendency further in the future. The study suggests an immediate drought mitigation plan for drought prone areas, especially for the *Yala* cropping seasons.

Keywords: Drought, Drought indices, Innovative trend analysis, Meteorological drought, Standardized precipitation index

DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF A PULL TYPE SINGLE ROW MAIZE SEEDER

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Maize (*Zea mays)* is the second most widely grown cereal crop in Sri Lanka and high labor cost in cultivation is major problem in reducing the farmer profit. Most of the farmers reluctant to use available mechanical seeders due to high initial cost and some operating drawbacks of them. Therefore, this study intended to introduce a user friendly and affordable maize seeder with a high field capacity and efficiency. It has several components such as seed hopper, seed metering mechanism, seed tube, furrow opener, furrow closer, ground wheels, power transmission system and handle. The material cost for the production was only LKR4500 making it affordable for small scale farmers. The total weight was 5.65Kg facilitating the operation by a single operator. The actual and theoretical field capacities, efficiency, number of seeds per hill, planting depth and spacing of the seeder were tested for both completely prepared fields (with primary and secondary tillage) and incompletely prepared fields (only with secondary tillage) using male and female labors, separately with three replicates. The suitable forward speed for better operation was $0.164 \, \text{ms}^{-1}$. Average number of seeds per hill and average planting depth were 2 and 3.7 cm, respectively. The within row spacing is properly maintained by machine itself. The results manifested that, the actual field capacities for female and male labors at completely prepared fields were $0.0327 \, \text{hah}^{-1}$ at 90% efficiency and $0.0329 \, \text{hah}^{-1}$ at 91% efficiency respectively. Corresponding values in incompletely prepared fields were $0.0321 \, \text{hah}^{-1}$ at 89% efficiency and $0.0323 \, \text{hah}^{-1}$ at 90% efficiency, respectively. Data were analyzed using ANOVA with 95% confidence intervals. The results showed that, type of land preparation and gender of labor have no effect ($p > 0.05$) on the efficiency of the machine. Due to the affordability, user friendliness, higher capacity and efficiency, the machine can be recommended for maize cultivation.

Keywords: Field capacity, Field efficiency, Single raw maize seeder