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Agricultural Engineering

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VASANTRAO NAIK MARATHWADA KRISHI
VIDYAPEETH, PARBHANI**

Title - **Design and development of shredder cum briquetting machine**

Researcher - Manjunatha, B.S.

Research Guide - Ramteke, R.T.

Department - Agricultural Engineering

Subject - Farm Machinery and Power

Degree - M.Sc

Thesis No. - 17153

Krishikosh link - <http://krishikosh.egranth.ac.in/handle/1/5810034011>

Abstract -

Agricultural residues are producing in large amount but they are used inefficiently that pollute the environment. Apart from the problems of transportation, storage, and handling, the direct burning of loose biomass in conventional grates is associated with very low thermal efficiency and widespread air pollution. To overcome these problems the biomass materials is compressed and increased its density. The properties study of biomass was carried out for the details estimation of characteristics of biomass. The biomass characteristic like Bulk density, Sphericity, Arithmetic and Geometric mean diameter, Moisture content, Calorific value were carried out during the study. The proximate analysis of briquettes was also done during the study.

The shredder cum briquetting machine was designed and developed as per standard procedure, for shredder chopping length varied in the range of 3.2 to 5.5 mm and output capacity was varied in the range of 20-48 kg h⁻¹ and For briquetting machine 120 kg h⁻¹ capacity and the 30 mm diameter and 60 mm length of briquettes found as per design. Detail design calculation of screw, drive power required, pulley design, and required speed were done for screw press briquetting machine. The drive power of 2 hp motor was used to get the denser briquette through this developed screw press.

The economic analysis of the briquetting process was evaluated for the net annual benefit , benefit to cost ratio and payback of the system and found to be Rs. 32988, 4.6 and 1.72 years respectively.

Title	-	Design development and performance evaluation of inclined plate bullock drawn cotton planter cum fertilizer drill
Researcher	-	Chate, P.P.
Research Guide	-	Tekale, D.D.
Department	-	Agricultural Engineering
Subject	-	Farm Machinery and Power Engineering
Degree	-	M.Tech
Thesis No.	-	17170
Krishikosh link	-	http://krishikosh.egranth.ac.in/handle/1/5810034056
Abstract	-	

Total area under cotton production in India is about 118.81 lakh ha and cotton production of India is about 352 Lakh bales (1 bale = 170 kg) in 2015-2016 (Ministry of Agriculture). There are nine major cotton growing states in India which fall under three zones viz. the North zone (Punjab, Haryana and Rajasthan), the Central zone (Maharashtra, Madhya Pradesh and Gujarat) and the Southern zone (Andhra Pradesh, Karnataka and Tamil Nadu). In the country, nearly 65 per cent of cotton is cultivated under rain fed conditions.

As far as Maharashtra is concern, the Bullock drawn cotton planting is not significantly used due to the unavailability of suitable bullock drawn cotton planter at minimum cost for the improved method of cotton practices such as seed spacing and seed rate, plant population and fertilizer dose at the time of sowing especially for Bt. Cotton as recommended by the CICR, Nagpur and VNMKV, Parbhani, Maharashtra, India.

In the light of foregoing discussion and facts, the need of undertaking this project was that numbers of problem were found in existing cotton practices, manual sowing of cotton and the large no of labour requirement. Therefore it was indirectly increase the production cost for the farmers in large aspects. Then finally it affects the benefit cost ratio. To successfully establish crops over the range of conditions likely to exist at a planting, a planter should be able to open a furrow, meter the seed and fertilizer, deliver and place them appropriately in soil.

The Bullock Drawn Cotton planter cum fertilizer drill has many other advantages to control depth, working width, seed and fertilizer rate and maintain the spacing between the rows

and plants also provide the fertilizer at the time of sowing as recommended by the CICR, Nagpur and VNMKV, Parbhani, Maharashtra, India.

This newly developed machine was evaluated in the laboratory as well as in the field for its performance. It does the function to plant the cotton seed simultaneously place the fertilizer on the required row to row and plant to plant spacing with average field capacity of 0.344 ha/hr for 90 cm row spacing at the speed of 2.39 km/hr. The planter can be used to plant the cotton seed on in the field at required row to row and plant to plant spacing and simultaneously place the fertilizer on the same row. The depth of operation was found to be 3.8-4.5 cm which is suitable as the required depth for cotton planting is 3 to 4 cm. The shovel type furrow opener plays the important role by placing the fertilizer nearer to seed at a distance of 50 mm as the required distance for fertilizer from the seed is about 50 mm. The seed covering device and row marking devices was provided which was working Satisfactory. The performance of Inclined Plate seed metering device only for cotton seed is satisfactory. It gives desired seed rates of 2-4.0 kg/ha, 1.5-3 kg/ha and 1-2.3 kg/ha for the spacing of 90 x 30 cm, 90x 60 cm and 90 x 60 cm respectively. The recommended plant to plant spacing varies from 30 cm, 45 cm and 60 cm by changing the inclined plate with variable cell on the edge of the plate as per the design. The average percentage of missing hills obtained was 3.5 per cent for 30 cm plant spacing, 3.8 per cent for 45 cm plant spacing and 3.3 per cent for 60 cm plant spacing. The row to row distance can be changed easily by sliding the tyne from 90, 105, 120 and 135 cm which was recommended for cotton planting. The average draft requirement of the planter cum fertilizer drill during the field test is 65.89 kgf for 90 cm spacing.

Title	-	Process standardization of ready-to-eat pearl millet snack food (kharodi)
Researcher	-	Solanke, SwetaBhagwanrao
Research Guide	-	Jayebhaye, R.V.
Department	-	Agricultural Engineering
Subject	-	Agricultural Process Engineering
Degree	-	M.Tech
Thesis No.	-	17174
Krishikosh link	-	http://krishikosh.egranth.ac.in/handle/1/5810034060
Abstract	-	

The aim of this study was to standardize the process parameters for preparation of *Kharodi*, a pearl millet based ready-to-eat traditional snack food. Traditionally developed food products facilitate consumption of cereals in more natural form and have long shelf life. It is easily digestible, rich in protein and more popular in Maharashtra, Karnataka, Rajasthan and in northeastern part of India. It is prepared by a simple process from *Bajarior* sorghum gritty flour and is fortified by adding salt, spice (*mirch*), garlic paste, sesame for taste. Then cooked and sun dried in small chunks.

A survey was carried out in different representative districts and the general process of *Kharodi* preparation and ingredients required were selected. In order to select proper flour particle size, three flour samples with coarse, medium and fine particle size (0.172, 0.166, 0.153 mm respectively) were prepared to test the effect of flour particle size on cooking and pasting properties, workability of cooked dough and quality attributes of final dried product. The flour and ingredients were cooked in open pan and small chunk were dropped on perforated trays. The chunks were dried in tray drier in order to test the feasibility of mechanical drying. On the basis of quality attributes and sensory evaluation the medium flour particle size of 0.166 mm was selected for further experiments.

The experiments were analyzed by using CCRD. The pearl millet grits and ingredients could be optimally cooked at 1979.92 ml water level at 20 min cooking time and dried at 65 °C temperature for 8.79 h followed by oven toasting at 105 °C for 60 min to prepare ready-to-eat *Kharodi*. The fuzzy logic based sensory evaluation indicated that fried *Kharodi* sample was more

preferred over non-fried sample and *Kharodi* with sesame sample. The sensory evaluation by using fuzzy logic indicated that the present technology is suitable for the preparation of RTE *Kharodi*.

Title - **Studies on shelf life of peeled garlic cloves**

Researcher - Wadmare, V.S.

Research Guide - More, P.G.

Department - Agricultural Engineering

Subject - Agricultural Process Engineering

Degree - M.Tech

Thesis No. - 17188

Krishikosh link - <http://krishikosh.egranth.ac.in/handle/1/5810034092>

Abstract -

The study regarding evaluation of shelf life of peeled garlic cloves was undertaken at the Department of Agricultural Process Engineering, VNMKV Parbhani. Parameters such as weight loss, pH, firmness, microbial load and organoleptic properties of peeled garlic cloves were measured during both refrigerated and ambient conditions (22⁰ C and RH 55% to 65%). Peeled garlic cloves were packed in percent perforations of different thickness (gauge) packaging materials such as LDPE, HDPE and plastic punnet. Results shown that quality characteristics of peeled garlic cloves such as weight loss, pH, colour changes, firmness, microbial load and organoleptic properties were found to be better in plastic punnet followed by LDPE bag for both storage conditions. Plastic punnet was found to be best suitable packaging material among all other perforated packaging materials. The maximum shelf life for peeled garlic cloves was observed as 25 days and 10 days when stored in 2% perforated plastic punnet refrigerated and ambient storage condition.

Title	- Trend analysis of Rainfall and Temperature variability in Marathwada region
Researcher	- Saranya, A
Research Guide	- Payal, S.D.
Department	- Agricultural Engineering
Subject	- Soil and Water Conservation Engineering
Degree	- M.Tech
Thesis No.	- 17197
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810034127
Abstract	-

The present investigation entitled “Trend analysis of Rainfall and Temperature variability in Marathwada region” was undertaken to study the temporal variation of meteorological parameters such as rainfall and temperature (maximum and minimum) and to perform the trend analysis of these parameters. The daily meteorological data of 21 years (1994-2014) for Marathwada region (Maharashtra) was collected and the data was arranged and grouped in monthly and annual time scales. The statistical parameters such as Mean, Standard deviation and Coefficient of variation were calculated on annual and monthly basis. On the basis of variation in climatic parameters the trend analysis was interpreted for that period. For the monthly temporal analysis the daily temperature data (max and min) was averaged or summed up into month from January to December for the period of 1994 to 2014. Whereas for monthly rainfall analysis, rainfall data from June month to October was analyzed. Trend analysis was performed by using Mann Kendall test which is non parametric test. Trend analysis of various climatic parameters was performed for monthly and annual form with corresponding years at 95% probability level. Weekly rainfall frequency was also investigated.

The results obtained in the study shows that in last 21 years increase in trend of monthly rainfall in Kavaykheda and Shahagad station during July, Awadshirpur station during August and Manoor station during October from 1994-2014. Decreasing trend in monthly rainfall was observed in June for Manoor station, June & October for Sapli dam station, June & August for Sundgi station, October for Awadshirpur, Potanandgaon and Takli station from 1994-2014. Annual rainfall shows downward trend in six out of eight stations (Sundgi, Potanandgaon, Takli, Manoor, Awadshirpur, Sapli dam) and an upward trend in Kavaykheda and Shahagad for 21 years (1994-

2014). Monthly maximum temperature results revealed that only Manoor station shows increasing trend and Shahagad, Awadshirpur, Takli, Sundgi, Potanandgaon station shows significant decreasing trend. Annual maximum temperature shows significant decreasing trend in Awadshirpur station and significant increasing trend in Manoor station. Monthly minimum temperature result shows significant increasing and decreasing trend in Potanandgaon and Awadshirpur station. Manoor and Shahagad station shows significant increasing trend in some month. Sundgi and Takli station shows significant decreasing trend in some months. Annual minimum temperature result shows significant increasing trend in Awadshirpur, Manoor and Shahagad stations and decreasing significant trend in Sundgi station. Weekly rainfall frequency analysis shows that more than 70% rainfall was occurred during 25th to 39th week in Marathwada region during the study period

Title	-	Studies on rainwater harvesting and reutilization for protective irrigation with farm pond
Researcher	-	More, Ram Manikrao
Research Guide	-	More, M.R.
Department	-	Agricultural Engineering
Subject	-	Soil and Water Conservation Engineering
Degree	-	M.Tech
Thesis No.	-	17203
Krishikosh link	-	http://krishikosh.egranth.ac.in/handle/1/5810034158
Abstract	-	

The research on, ‘Studies on rainwater harvesting and reutilization for protective irrigation with farm pond’ was conducted during the year 2016-17 at demonstration farm of the VasantNaikMarathwadaKrishiVidyapeeth, Parbhani. The daily depth of water impounded in the farm pond was recorded for developing stage-storage relationship of the farm pond. Daily rainfall and pan evaporation data was collected from the Meteorological Observatory of the VasantNaikMarathwadaKrishiVidyapeeth, Parbhani. For estimation of the loss of water through evaporation from farm pond, daily pan evaporation data was multiplied by pan coefficient (0.70). The daily water loss through evaporation (m^3) from the farm pond was calculated by multiplying daily depth of water evaporated from the farm pond to the water storage area for a particular day. The daily water storage area and volume of water impounded was estimated for particular depth of impounding of water from stage storage relationship of the farm pond.

The harvested water in the farm pond was utilized for applying protective irrigation to the pigeon pea crop. The experiment consisted six replications and two treatments. One protective irrigation for pigeon pea at pod development stage (T_1) was applied on 30.11.2016. The treatment T_2 consisted without protective irrigation to pigeon pea. The grain yield of pigeon pea was recorded plot wise. The grain yield data was analyzed using MAUSTAT software and results obtained were compared treatment wise.

For economic analysis of the treatments, cost of cultivation, cost of cultural operations, fixed and operational costs of pump and accessories were calculated. These total cost

was be used to determine the gross monetary returns (GMR), net monetary returns (NMR) and benefit cost ratio (B:C ratio).

The area of top section and bottom section of the farm pond was 279.75 m² and 516.82 m² respectively. The average elevation of embankment at top was 413.130m. The average elevation of bottom of pond was 410.210m. The elevation at the bottom of outlet was 412.437m. The maximum depth of water impounded and maximum storage volume in the farm pond was 2.165m and 933.99m³ respectively.

The total water evaporated through farm pond for the month of July, August, September, October, November and December 2016 was found to be 19.14 m³, 32.60m³, 25.40 m³, 35.9882m³, 29.8620m³ and 1.1965 m³ respectively. The maximum water evaporated through the farm pond was recorded in the month of October-2016. Total evaporation loss through the farm pond recorded was 144.17 m³. The seepage loss through the pond for the month of July, August, September, October, November and December 2016 was found to be 634.88, 358.05 m³, 651.80 m³, 611.64 m³, 147.33 m³ and 37.89 m³ respectively. The maximum water seepage through the farm pond was recorded in the month of September -2016. The total seepage loss recorded through the farm pond was 2441.59 m³.

The harvested water in the farm pond was utilized for irrigating the pigeon pea crop at its pod development stage. One of protective irrigation (T₁) recorded significantly higher pigeon pea grain yield than treatment of without protective irrigation (T₂). Due to the one protective irrigation, 27.30 per cent grain yield increased over or control was observed.

The study revealed that the treatment T₁ *i. e.* one protective irrigations at pod development stage recorded highest GMR (111302.00Rs/ha) and NMR (76302.00) as compared to control (T₂) *i. e.* without protective irrigation. The benefit- cost ratio (2.18) is found to be higher under the treatment T₁ *i. e.* one protective irrigation pod development stage. The lowest B:C ratio (1.69) is estimated under the treatment T₂ (without protective irrigation).

Title	-	Development of rainfall intensity-duration-frequency relationship for hingoli and jalna district locations
Researcher	-	Jagtap, R.D.
Research Guide	-	Bhuibar, B.W.
Department	-	Agricultural Engineering
Subject	-	Soil and Water Conservation Engineering
Degree	-	M.Tech
Thesis No.	-	17205
Krishikosh link	-	http://krishikosh.egranth.ac.in/handle/1/5810034161
Abstract	-	

Rainfall is one of the important factors in planning agricultural programs for an area. With rapid population growth and rapid expectation for better life, the natural resources of our earth facing increasing pressure. It is of paramount importance that basic resources for human survival viz. air, land and water must be managed efficiently. The aim of this study was to determine rainfall intensity-duration-frequency relationship and develop nomographs of rainfall intensity-duration-frequency for Hingoli and Jalna stations.

The data in the form of rain gauge charts of 15 years (2002 to 2016) for Jalna and Hingoli locations were collected from Jalvignyankendra Jalna and Nanded and analyzed for determination maximum annual rainfall intensities for selected duration of 0.08, 0.16, 0.25, 0.5, 0.75, 1.0, 2.0, 3.0, 6.0, 12.0 and 24.0 hours.

Developed relationship of rainfall intensity duration frequency and corresponding nomograph of Jalna and Hingoli locations of Marathwada region were observed design rainfall parameter accurately within acceptable limit developed relationship and nomograph of these locations are useful for estimation of design rainfall parameter for design of soil conservation and runoff water conveying structures in the region

The rainfall intensity-duration-return period equations for Jalna and Hingoli were developed from rainfall data. The equation for both stations is as follows:

$$I = \frac{12.15T^{0.09422}}{(t + 1.0)^{1.1762}} \quad \text{----- Jalna station}$$

and

$$I = \frac{15.56T^{0.1116}}{(t + 1.0)^{1.1476}} \quad \text{----- Hingoli station}$$

The nomographs for obtaining the quick solution of rainfall intensity-duration-return period equation were developed for Jalna and Hingoli stations. The maximum deviation in the values of intensities obtained from mathematical relationship of intensity-duration-return period equation and corresponding nomograph is in the range of -1.12 to 14.28% Which is less than the accepted range of 20% .Thus the nomograph developed in the study can be used for obtaining the solutions of rainfall intensity- duration-return period relationship.

Title - **Development and performance evaluation of sorghum stalk cutter**

Researcher - Alankar, N.A.

Research Guide - Mundhe, P.A.

Department - Agricultural Engineering

Subject - Farm Machinery and Power Engineering

Degree - M.Tech

Thesis No. - 17212

Krishikosh link - <http://krishikosh.egranth.ac.in/handle/1/5810034178>

Abstract -

Sorghum (*Sorghum Vulgare* and *Sorghum, Pers*) is one of the most important cereal crop in India which ranks fifth to wheat, rice, maize and barley in area and production also. It is grown twice in year viz. kharif and rabi season.

In India it is mainly grown in the Deccan plateau, central and western India apart from a few patches in northern India. In Maharashtra, area under Sorghum crop is nearly equal to 50.5 percent to the total area under Sorghum in India. It is nutritionally superior to other fine cereals such as rice and wheat and hence known as nutritional cereal (N. Seetharama 2006).

In Maharashtra 83 percent of agricultural land is under dry land farming and Sorghum is most popular crop among the millets grown in dry land under rainfed cropping pattern. It is grown in both rabi and kharif under rainfed conditions by providing protective irrigation. In Maharashtra, Sorghum is grown not only for food grain purpose but also for fodder purpose and now a day, in western countries and in India also an ethanol production from sweet Sorghum varieties on commercial basis is emerging.

Hybrid varieties of Sorghum are grown in kharif season, few of them are CSH-9, SPH-388, PVK-801 (ParbhaniSweta). In rabi season M-35-1 is most popular among farmers while others few of them are SPV-1411 (ParbhaniMoti), PhuleMauli, PhuleYashoda etc.

In Marathwada region Sorghum is one of the popular crop among the farmers, mainly in Parbhani, Nanded, Latur districts. Yield of Sorghum varies between 25 to 30 quintals per hectare

depending on the varieties, agronomic practices, irrigation facilities etc. Generally, Sorghum is taken as intercrop in soybean, pigeon pea and safflower in pair row.

The harvesting of Sorghum requires twice cutting of stalk, one at top for separating cobs i.e. known as nipping and second type of cutting is at the bottom for fodder purpose i.e. known as ripping, so double labour is required for harvesting of this crop. Harvesting is the most labour intensive and tedious operation in the Sorghum production; secondly, it is time consuming operation.

Also high labour wages coupled with its scarcity during the peak period of harvesting leads to increase in the cost of harvesting and simultaneously the cost of production, which reduces the net profit of farmers.

In kharif (hybrid) varieties of Sorghum, stalks are being cut proper height from ground level. General practice adopted by the farmers for Sorghum harvesting in rabi season is uprooting the crop. Another separate operation is necessary to cut the cobs. The traditional method of harvesting is manual harvesting by using sickles. Serrated hand sickle is the only improvement made until now over traditional sickles. These sickles are light in weight, improved in design and easy for operation. However, such sickles have not been adopted on large scale. Also the sharpening of serrations is another problem associated with these sickles.

The shortage of labour is thus to be bridged by mechanization. A suitable bullock drawn machine for harvesting of Sorghum crop can reduce drudgery, reduce losses, increase productivity and reduce turn about time in two crop season. And also avoid weather risk, achieve low cost of harvesting and derive benefit from early marketing of produces.

Considering the socio-economic background of farmers of Maharashtra i.e. the Sorghum crop is mostly popular among dry land farmers, land holdings of farmers of Maharashtra are so small, the large machinery with highly mechanized devices is not feasible. Among most of the farmers bullock drawn implements are very popular as they have their own pair of bullock as power source with them as well as it is readily available power source for farmers at rural level. It was observed that power developed by the bullocks for the cutter is less due to traction. So it was decided that a separate power source (Engine) will be provided for the cutting mechanism.

Hence, analyzing the above discussed problems, the efforts have been made to develop a bullock drawn engine operated sorghum stalk cutter at “College of Agricultural Engineering and Technology, V.N.M.K.V., Parbhani” The study was aimed to develop and fabricate a bullock drawn machine that will cut and windrow the stalk of Sorghum stalks efficiently. The study was carried out with the following objectives.

Title - **Design and development of bullock drawn multipurpose tool carrier**

Researcher - Waghmare, Ajay Annasaheb

Research Guide - Solanki, S.N.

Department - Agricultural Engineering

Subject - Farm Machinery and Power

Degree - M.Tech

Thesis No. - 1758

Krishikosh link - <http://krishikosh.egranth.ac.in/handle/1/5810033469>

Abstract -

In Maharashtra, the crossbred cattle have increased by 12.9 per cent but indigenous cattle decreased by 13.4 per cent during the period between 16th and 17th census. There is a decrease of 9.8 per cent in total cattle population during the intercensal period. Draught animal population of Maharashtra State is 62, 47,213 decreased by 3.57 per cent during the period between 16th and 17th census. Draught animal population of Marathwada during 2007 is 15,52,190 increased by 4.15 per cent over 2003. Unit farm power availability of Maharashtra is 0.86 kW/ha (2012-2013) with 17 per cent of contribution of draught animal. It is also estimated that nearly 80% of the total draft power used in agriculture throughout is still provided by the animals.

The main power source of the agriculture in Maharashtra is draught animals and majority of the small and marginal farmers depend on the draught animals for performing farm operations. Though considerable mechanized/ improved bullock drawn equipment's are available but due to lack of awareness, its use is limited. Day by day shortage of labour and increased wages of labour increasing cost of operation, simultaneously the cost of rearing of draught animal is become great problem for small and marginal farmers. This leads to identification of mechanization gap, increase of annual hour's use of draught animal in different farm operation by adopting improved implement.

In case of MPTC the bullock drawn planter can be used to plant the seed at required row to row and plant to plant spacing and simultaneously place the fertilizer on the same row covering the seed and spraying weedicide. The average draft required for planter cum spraying and inter cultivation was 62 and 58 kg respectively. The theoretical field capacity and

efficiency for the planter cum sprayer and inter cultivation was 0.189, 0.32 ha/h and 88%, 65% respectively. The Average speed of operation of planter cum sprayer was 2.10 kmph and three tyne hoe with furrow opener was 1.8 kmph. The weeding efficiency of three tyne hoe with two furrow opener was 84 %. The average seed rate obtained is 63-67 kg/ha and fertilizer rate is 92-96 kg/ha. Only one labor is required to operate machine. An average discharge from each nozzle was in the range of 195.97 to 197.66 ml/min.

Title	-	Studies on effect of different mulches on soil physical properties, moisture conservation and yield of drip irrigated watermelon
Researcher	-	Pawar, P.S.
Research Guide	-	Kadale, A.S.
Department	-	Agricultural Engineering
Subject	-	Soil and Water Conservation Engineering
Degree	-	Ph.D.
Thesis No.	-	17181
Krishikosh link	-	http://krishikosh.egranth.ac.in/handle/1/5810034078
Abstract	-	

Mulches are used for various reasons but water conservation and erosion control are the most important objective for its use in agriculture in dry regions. Irrigation when used in combination with mulch typically need less water to meet the crop requirement as the other losses are kept under minimum thereby increasing the use efficiency of water. The water scarcity to agricultural crops is a major problem under Marathwada region of Maharashtra. In view of this, the present investigation entitled, “Studies on effect of different mulches on soil physical properties, moisture conservation and yield of drip irrigated watermelon” was carried out in *summer* season during two consecutive years viz., 2015 and 2016 at the research farm of All India Co-ordinated Research Project on Irrigation Water Management, VasantNaikMarathwadaKrishiVidyapeeth, Parbhani.

The present study was aimed with specific objectives: to study the effect of different mulches on soil physical properties, soil moisture conservation, growth, yield & growth attributing characters of drip irrigated watermelon and to study the economic feasibility of mulching for drip irrigated watermelon.

The field experiment was laid out in split plot design, wherein main plots were assigned to three irrigation levels based on daily pan evaporation data (I₁ – drip irrigation at 60 % of pan evaporation, I₂ – drip irrigation at 80 % of pan evaporation and I₃ – drip irrigation at 100 % of pan evaporation) and sub plots to four mulches BPM – Black polythene mulch (30 μ), TPM – Transparent polythene mulch (30 μ), SSM – Soybean straw mulch (5 tonns/ha) and C – Control (without mulch).

Amongst the mulches, transparent polyethylene mulch recorded the highest excessive mean soil temperature on an average 2.5 and 5.3 °C relative to control during growing season 2015 and 2016 respectively. The mean soil temperature under black polythene mulch was on an average 2.2 and 3.0 °C higher than control during growing season 2015 and 2016 respectively. In case of soybean straw mulch, lower mean soil temperature was recorded on an average 0.6 °C (1.2 – 0.3 °C) than control during both the year of experimentation.

The results effect of various mulches on soil moisture content indicated that the mulched plots had higher soil moisture content than non-mulched plots, which has positively reflected on vegetative and yield parameters. The maximum soil moisture content was recorded in drip irrigation with polythene mulch followed by drip irrigation with soybean straw mulch treatments as compared to treatments of drip irrigation with no mulch. The black polythene mulch conserves soil moisture by 9.27 and 11.03 per cent over the control in 2015 and 2017 respectively. At the same soil profile, the transparent polythene mulch conserves soil moisture by 6.52 and 9.96 per cent over the control in 2015 and 2016 respectively. Similarly, the per cent increased soil moisture content for soybean straw mulch was found 4.81 and 5.33 over the control in 2015 and 2016. The effect of different mulch treatments on dry bulk density, total porosity and basic infiltration rate was found non-significant. The result of water use efficiency revealed that, water was used most effectively with combination of drip irrigation at 0.8 PE and black polythene mulch.

All the plant growth and yield attributing characters were superior with black polyethylene mulch while, plants without mulch (control) resulted in poor growth and yield. The black polythene mulch recorded maximum yield i.e. 31.85, 25.95 and 28.90 t/ha which was followed by transparent polythene mulch and soybean straw mulch respectively during two years of experimentation and in pooled analysis. Irrigation levels and mulches did not have any significant effect on fruit quality parameters. With economic point of view, black polythene mulch resulted in the highest net return and found to be more economical with highest B:C ratio.

Title	- Design and development of power operated chaff cutter cum grinder mechanism
Researcher	- Nimbalkar, D.V.
Research Guide	- Shinde, G.U.
Department	- Agricultural Engineering
Subject	- Farm Machinery and Power Engineering
Degree	- M.Tech
Thesis No.	- 17166
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810034048
Abstract	-

The present research work introduces a dual mechanism of harvested fodder preparation for the animals. The assembled machine structure for chopping and grinding operation is considered for 2 hp motor energy. The conceptual Computer aided design of machine is prepared in the CAD software as a solid model with assembly function as per the requirements and estimated specification of the materials to be converted in the physical model by a fabrication work. Further to that its performance evaluation in accordance with small and marginal farmers need and average fodder capacity for animal is derived for maintaining a size shape and operational performance by its design optimization. The size of the machine is 1.5 x 1.2 x 1.5 cm³ in which the raw grain up to 15 kg.

The newly developed Chaff cutter cum grinder machine model delivers an excellent productivity in fodder production. The quality of fodder is exercised with day to day animal feed and identifying a consistency in chaffing and grinding operations for desired dimensions. The continuous production of fodder for a period of month records of the information and animal likely hoodness.

The small and marginal farmers are doing a side business of poultry, goat farm, buffalo and cow dairy farming as useful source for their economy and so, most times farmers are given the grinded material as a fodder to the animal. Traditionally the farmers are using sickle or axe to cut the stalk in to the pieces which are time consuming operations, require more human energy and also these operations are injurious to the human body. Keeping these points in view, the new power operated cylindrical type chaff cutter cum grinder was developed (2 HP). The chaff cutter

cum grinder consists of feeding hopper, main frame, head unit, cutting unit, discharge unit, power unit and power transmission unit. The chaff cutter cum grinder was tested for wet and dry fodder and grain crops *viz.* sorghum, maize.

In cutting unit there is a provision of one fixed shear plate and other two rotating blades. The power required to cutting unit for cutting fodder and grinding the materials at required length gets from prime mover of 2 HP electric motor to the shaft and shafts through proper belt pulley and arrangement at desired rpm. When the fodder comes in contact with blades by the action of impact and shearing of rotating blade the fodder was cuts in to small pieces and delivered to the discharge unit and the chaffed fodder was collected at the discharge unit by doing the changes into the chaff cutter cum grinder to lock the fodder hopper and fix the sieves in to the machine it acts as an grinder and providing the material through same discharge unit of its proper size whichever is fixed according to the sieve size.

The performance of the chaff cutter cum grinder was tested and results were analyzed. The output capacity of machine for wet fodder was observed 330 kg-h⁻¹ for sorghum, 272 kg-h⁻¹ for maize and for dry fodder 202.9 kg-h⁻¹ for sorghum and 174.9 kg-h⁻¹ for maize also the performance of the grinder is 100 kg-h⁻¹ for the sorghum and 95 kg-h⁻¹ for the maize grains. Chaffing efficiency of the machine for wet fodder was observed 86.5 % for sorghum, 84.15 % for maize and for dry fodder it was found 86.3 % for sorghum and 80.5 % for maize and for the grinder it should be 95% and 96 % for the sorghum and maize grain On these results the overall performance of chaff cutter cum grinder was found satisfactory and it is suitable for small and medium farmers.