DEVELOPMENT AND TESTING OF A CONTINUOUS MIXING PLANT FOR POT MIXTURE

By

ANI. S. T.

PROJECT REPORT

Submitted in partial fulfilment of the requirement for the degree

Bachelor of Technology in Agricultural Engineering

Faculty of Agricultural Engineering
KERALA AGRICULTURAL UNIVERSITY

Department of Farm Power Machinery and Energy
KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
TAVANUR - 679573, MALAPPURAM.

1997

DECLARATION

I hereby declare that this project report entitled **"DEVELOPMENT AND TESTING OF A CONTINUOUS MIXING PLANT FOR POT MIXTURE"** is a bonafide record of project work done by me during the course and that the report has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

ANI. S.T.

Tavanur.
31st May 1997

CERTIFICATE

Certified that this project report entitled **"DEVELOPMENT AND TESTING OF A CONTINUOUS MIXING PLANT FOR POT MIXTURE"** is a record of project work done by ANI S.T under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to him.

JOBY BASTIAN
Assistant Professor
Department of FPME
KCAET, Tavanur.

Tavanur
31st May, 1997

ACKNOWLEDGMENT

With deep sense of gratitude and due respect I express my heartfelt thanks to my project guide Sri. Joby Bastian, Assistant Professor, Department of Farm Power Machinery and Energy, KCAET, Tavanur, for his painstaking guidance, constructive and creative suggestions, constant encouragement and help at each and every stage of this study.

I exploit this opportunity to thank Dr. K. John Thomas, Dean, KCAET, Tavanur, Prof. C.P. Mohammed, Head of Department of FPME, Prof Jippu Jacob, Associate Professor, Department of FPME and Dr. P.V.Habeeburrahman, Assistant Professor, Department of SAC, KCAET, Tavanur for their support and profound encouragement during the project work.

I would not be fulfilling my duties if I donot mention a special word of thanks to Sri. K.C Joy and Sri. C.J James, Technicians but for whose kind hearted co-operation my project would not have been so succesful. I also aknowledge the co-operation and support rendered to me by the staff members of KCAET, especially to Sri. Rajeev M, Sri. Rajmohan C.K, Sri. Ajithlal T.V, Sri. T.P Aboobacker, Sri. C.Velayudhan, Sri. K.T Ramachandran, Sri. V.P Kannan and Surendran Pillai.T. for extending their help throughout my work.

My special thanks are also due to the students of KCAET, Tavanur especially to Sri. Bijukumar K. ,Binu Koshy , Pramod A.P, Shamsudheen K.P, Dhalin D, and Smt. Anu Shyam for their immense help during this work. I also extend my deep sense of gratitude to my parents for their help, support and encouragement.

Above all, I bow my head and dedicate myself to God Almighty, whose grace and blessing filled me with power to complete this hard task.

ANI S.T

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SYMBOLS AND ABBREVIATIONS

A	-	Ampere
AC	-	Alternating Current
cft	-	Cubic Feet
cm	-	Centimetre(s)
Ed.	-	Edition
Fig	-	Figure(s)
FPME	-	Farm Power Machinery and Energy
g	-	Gram(s)
hp	-	Horse Power
hr	-	Hour(s)
Hz	-	Hertz
ie.	-	That is
Ltd.	-	Limited
KAU	-	Kerala Agricultural University
KCAET	-	Kelappaji College of Agricultural Engineering & Technology
Kg	-	Kilogram(s)
Kw	-	Kilo watt(s)
Kwh	-	Kilo watt hour
m	-	Metre(s)
meq	-	Milliequalent
min	-	Minute(s)
mm	-	Millimetre(s)
MS	-	Mild Steel
No.	-	Number(s)
ppm	-	Parts per million
Pvt.	-	Private
rpm	-	Revolutions per minute
Rs	-	Rupees
SAC	-	Supportive and Allied Courses of Study
Sec.	-	Second(s)
TNAU	-	Tamil Nadu Agricultural University
Vol.	-	Volume
@	-	At the rate of
&	-	And
o	-	Degree
'	-	Feet
"	-	Inch
/	-	Per
%	-	Percentage

INTRODUCTION

From the dawn of human civilization man's ardent need for food has forced him to venture into several fields of life. Of all the means for food production, the concept of agriculture has come into prominence due to less risks involved in it and due to the reality available natural resources. Thus agriculture refers broadly to the technology of raising plants and animals. As man began to make progress in all spheres of life, he felt the need for sustaining the natural scenic beauty through artificial means also. Horticulture, which is a part of agriculture is concerned with production utilization and improvement of Fruits, Vegetables, Ornamental plants, Spices and Plantation Crops, including Medicinal and Aromatic plants.

The Indian sub-continent has always been considered as a safe heaven by the florists. The sub-tropical climate has been considered the best suited for growth of flowering plants. Thus due to high export potential, the floricultural industry is fast spreading. Plants having different growing conditions also find place in the new development of potting.

Man has resorted to potting because of its manifold advantages over other practices . The need of providing apt condition for plant growth has been the motivating force behind the concept of potting. One of the major constraints of floriculture is the typical soil composition required by the flowering plants. This ratio is very rarely found which has reduced the yields appreciably.

One definite advantage the potting plants have over those grown out door is that the soil mixture can be prepared in advance to ideally suit the plant with its soil preference. The growers of outdoor plants have to accept the existing soil and must make necessary alterations to provide the plants with a suitable growing environment. Drainage potential, pH and organic content of the out door soil are three concerns which the growers must determine and correct while these can be suitably provided initially in the case of potting. Growth of plants in pots limits the wastage of water and other natural resources to a great extent. Weeds have always caused problems during large scale growth of crops. This could be effectively curbed by individual growth of plants in pots.

Finally, the arrangements of plants in pots have increased scenic beauty when compared to the shabby and non-uniform growth of plants in farms. Keeping all these aspects in mind the project work entitled " Development and testing of a continuous mixing plant for pot mixture' was taken up with the following objectives.

1. To develop a Continuous Mixing Plant for pot mixture.
2. To test the Mixing Plant.

REVIEW OF LITERATURE

Growing plants in pots has always attracted man's vision when compared to the shabby and non-uniform growth of plants in farms. For a large number of pots, timely and efficient mixing of potting mixture could be attained by using a mechanical mixer.

Works done in the field of mechanical mixers are very few and are restricted to the past 30 years. The review of literature pertaining to the potting procedure, recommended potting mixtures and different types of mixers are described in this chapter.

2.1 Potting Media

There is no single best potting medium for growing plants and quality plants can be produced in vastly different media as long as irrigation practices are adjusted to the specific light and nutritional programmes. Most media are formulated from two or more ingradients to create a mix which has optimum physical and chemical properties. Most media are routinely amended with dolomite to achieve a pH of 5.5 - 6.5 and should include a micronutrient source. Other sources of major nutrients may be incorporated such as superphosphate, potassium or calcium nitrate or iron sulphate.

2.2 Suggested physical and chemical characteristics for potting media used to grow many types of foliage plants including ornamental Aroids are given below:

Characteristics	Desirable range
pH	5.5 - 6.5
Bulk density	
a. Dry	0.30 - 0.75 g/cm3
b. Wet	0.60 - 1.2 g/cm3
Total pore space	5 - 30% volume after drainage
Cation - exchange capacity	2 - 40 meq/100g dry weight
Soluble salts	400 - 1000 ppm (soil / water (1/2) by volume).
Water holding capacity	20-60% volume

2.3 Potting Soil Vs Natural Soil

Natural soil, even if it is good, does not make a good potting soil. There are several reasons why even good natural soils does not make a good potting soil. One is that the density of natural soil when moist is very high compared to specially prepared potting soils. Another reason is that in container gardening the soil depth is too shallow for good drainage. The lower part of the soil in a pot will always tend to be saturated long after irrigation because the pore spaces are small and gravity is not strong enough to pull all the excess water down and out.

To provide uniform potting mixtures of better textures, sand and organic matter, such as peat moss or saw dust or shredded bark, are usually added to the loam soil. In preparing these mixtures, the soil should be screened to make it uniform and to eliminate larger particles.

2.4 Potting procedure.

This consists of the following steps:

1. Place a small amount of the potting mixture in the bottom of the plot.
2. Hold the cutting in one hand and place it in the centre of the container, paying special attention to its height so that at least the bottom inch of the stem will eventually be covered with the potting mixture.
3. While holding the cutting in one hand use your other hand to carefully surround the roots of the cutting with the soil mixture until the pot is completely filled.
4. Use the fingers of both hands, to press the soil mixture firmly around the base of the cutting.
5. Make certain that the soil level is just below the rim of the pot so that the pot will be able to hold the water when it is applied.
6. Water the soil mixture thoroughly, directly after potting occurs.
7. Second water, two to three hours after being potted is also needed and examine closely for the first week for signs of wilting.

2.5 Recommended Potting Mixtures

(I) Using soil and mixed by volume are:

1 Heavy soils, such as clay loams or clay consists of:

2 parts perlite or sand

1 part soil and

2 part peat moss (or composted shredded bark, saw dust or leaf mold).

2 Medium soils, such as silt loams consists of:

1 part perlite or sand

1 part soil and

1 part peat moss (or composted shredded bark, saw dust or leaf mold).

3 Light soils, such as sandy loams consists of:

1 part peat moss (or composted shredded bark, saw dust or leaf mold) and

1 part soil.

(II) University of Florida foliage plant mixer

1 2 parts peat

1 part bark and

2 part shavings

2 2 part peat and

1 part bark

3 3 parts peat

1 part sand

(III) University of Hawaii medium for plant requiring good drainage

2 part cinders and

1 part wood shavings

(IV) Cornell university foliage plant mixer

1 Foliage plant mix

2 parts sphagnum peat

1 part horticultural perlite and

1 part horticultural vermiculate.

2. Epiphytic mix

1 part sphagnum peat

1 part horticultural pertite and

1 part Douglas tir bark.

2.6 Mixers.

2.6.1 Concrete Mixer.

The concrete mixer MAXINDIA is a tilting type mixer designed and perfected to suit to the requirement of all constructional activities. The mixing action is achieved by causing each part of the mix to be lifted in turn as the drum rotates and at a certain points of in each revolution allowing it to be dropped or directed towards the bottom of the drum where it combines with other parts of the mix continuously changing sequence to form a homogeneous mix.

The drum is a large diameter graded cast iron one with 10% extra load capacity. A large diameter spoked hand wheel is provided for easy tilting of drum truinnion assembly with a catch to look the hand wheel when the drum reaches the correct mixing angle. It is easy to operate and maintain. All running parts are provided with necessary lubrication systems and guards and convenience of lubrication is another advantage. A MAXINDIA concrete mixer is shown in Fig.1. the specification of two models of MAXINDIA concrete mixers are given in Appendix I

The ESI concrete mixer is similar to the MAXINDIA mixer. There are two models of the ESI mixer. In one, loading is done through a hopper provided at one side, while in the other, hand loading is done. The power for this mixer is provided from a HSD Diesel Engine/ motor. The ESI concrete mixer with hopper loading is shown in Fig.2. The specification of the ESI mixers are also given in Appendix I.

2.6.2 Food mixing plant.

Alwan (1963) developed a food mixing plant. Here grain is held in two 4t hoppers, each with a mill in its base. the mills discharge into two further 4t hoppers which discharge into a chain and flight conveyer, the later also being fed from a 10 - cwt concentrate hopper. From the conveyer, the meal is elevated to a hammer mill whence from a heated tank are also pumped into the mixer and the resulting feed fall then into trailers.

2.6.3 Mixer for peat and manure.

The mixer is rear mounted on a 54hp track lying tractor with a 2280 x 800mm dozer blade at the front to form separate parallel mounds of peat and manure. Two rotary shredders 1500mm long and 1200mm diameter, one above the other, pick up the peat and feed it to the transverse loading elevator 3400mm high which deposits the peat on top of the manure. then the machine mixes the manure and peat and either loads it into transport or forms another mound at the rate of 40 tones / hour.

2.6.4 Cowdung crusher.

The cowdung crusher developed by Jacob (1994) consists of eight blades, 4 each in two rows and mounted horizontally on a vertical shaft. Cowdung is fed at the top, where an opening is provided. The vertical shaft is rotated using a motor. The shaft and the blades are fixed inside the cylindrical container. As the shaft is rotated, the cowdung is crushed and the crushed cowdung will come out through the opening provided at one side of the bottom portion. The cowdung crusher is shown in Fig.3.

2.6.5 Seed Pelletizer.

A seed pelletizer which consists mainly of an aluminum pot fixed at one end of a shaft was developed by Narayanan (1995) at Coimbatore. The pot is held at an angle of 35^0 to the horizontal and is rotated at about 50 rpm. Measured quantity of building material such as gum accacis or rice gruel is also poured over the seed slowly so that the burden is dispersed all over the seed. The equipment cost Rs.600/- and its capacity is 2kg per batch and 200kg per day. Cost of operation is Rs.2.00 per quintal of seed.

2.6.6 Mixing plant for pot mixture.

Omman and Paul (1996) developed a continuous potting mixture plant for mixing sand, soil and cowdung to get a potting mixture having 1:1:1 proportion by volume. The plant was tested at different drum speeds and various angle of inclinations with the horizontal. It was found that, as the drum speed increased, the quality and mixing time was reduced for all angles except for 12.5^0 angle of inclination. Also as the angle of inclination increased, the quality & time was reduced. A drum speed of 52 rpm and 12.5^0 angle of inclination was found to be the best feasible speed and angle of inclination. The mixing plant is shown in Fig.4.

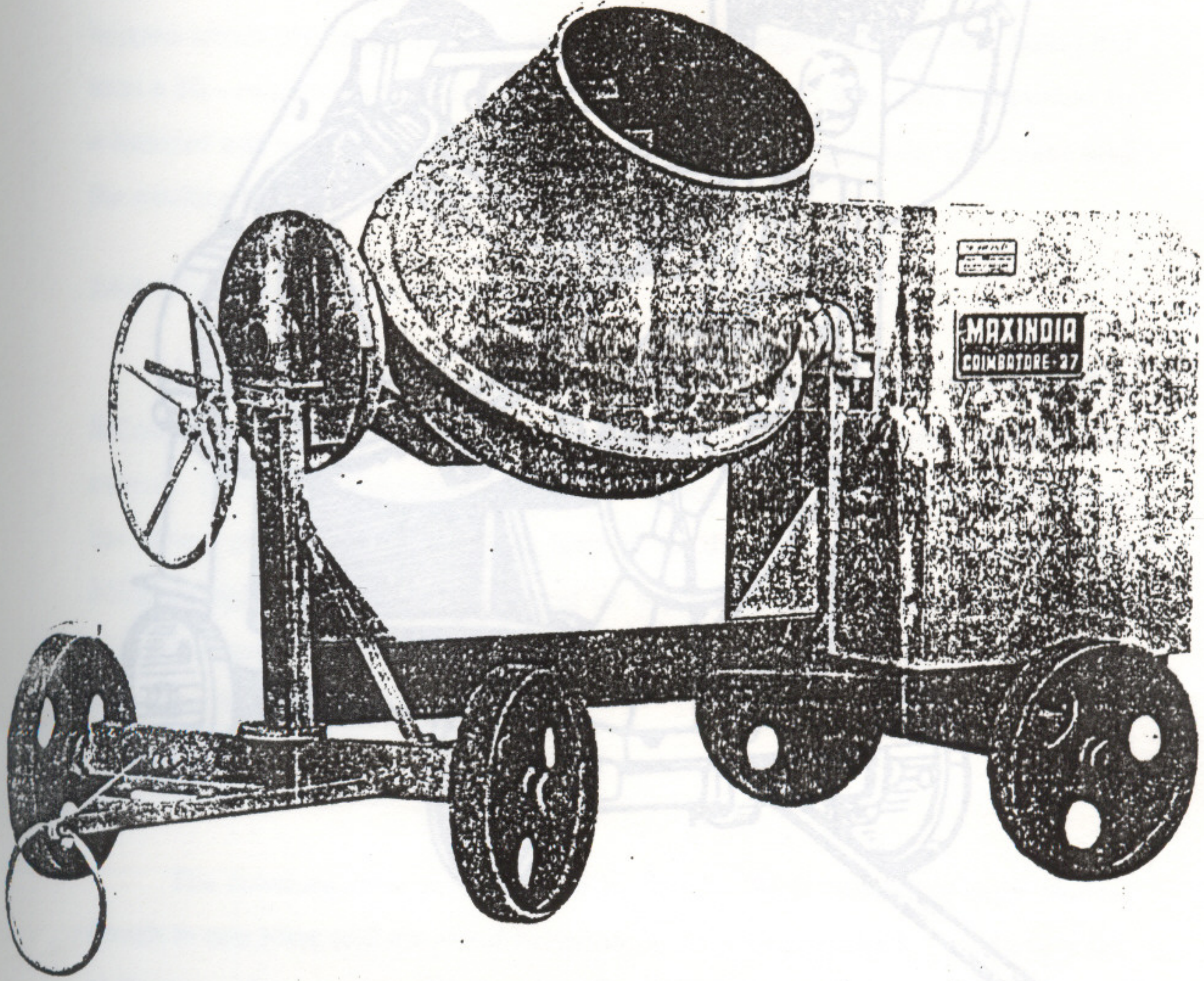


FIG.1. MAXINDIA CONCRETE MIXER

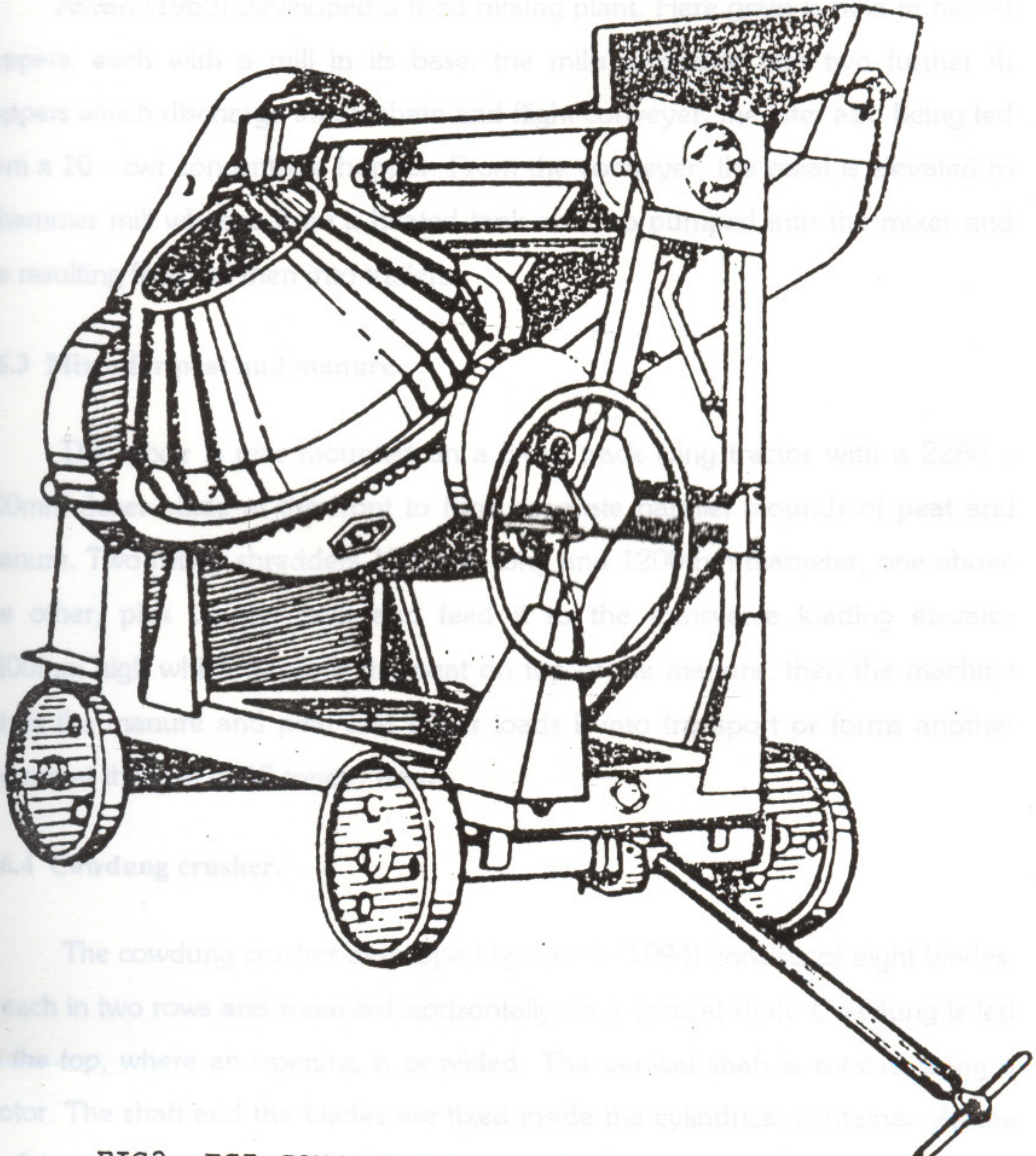


FIG2. ESI CONCRETE MIXER WITH HOPPER LOADING

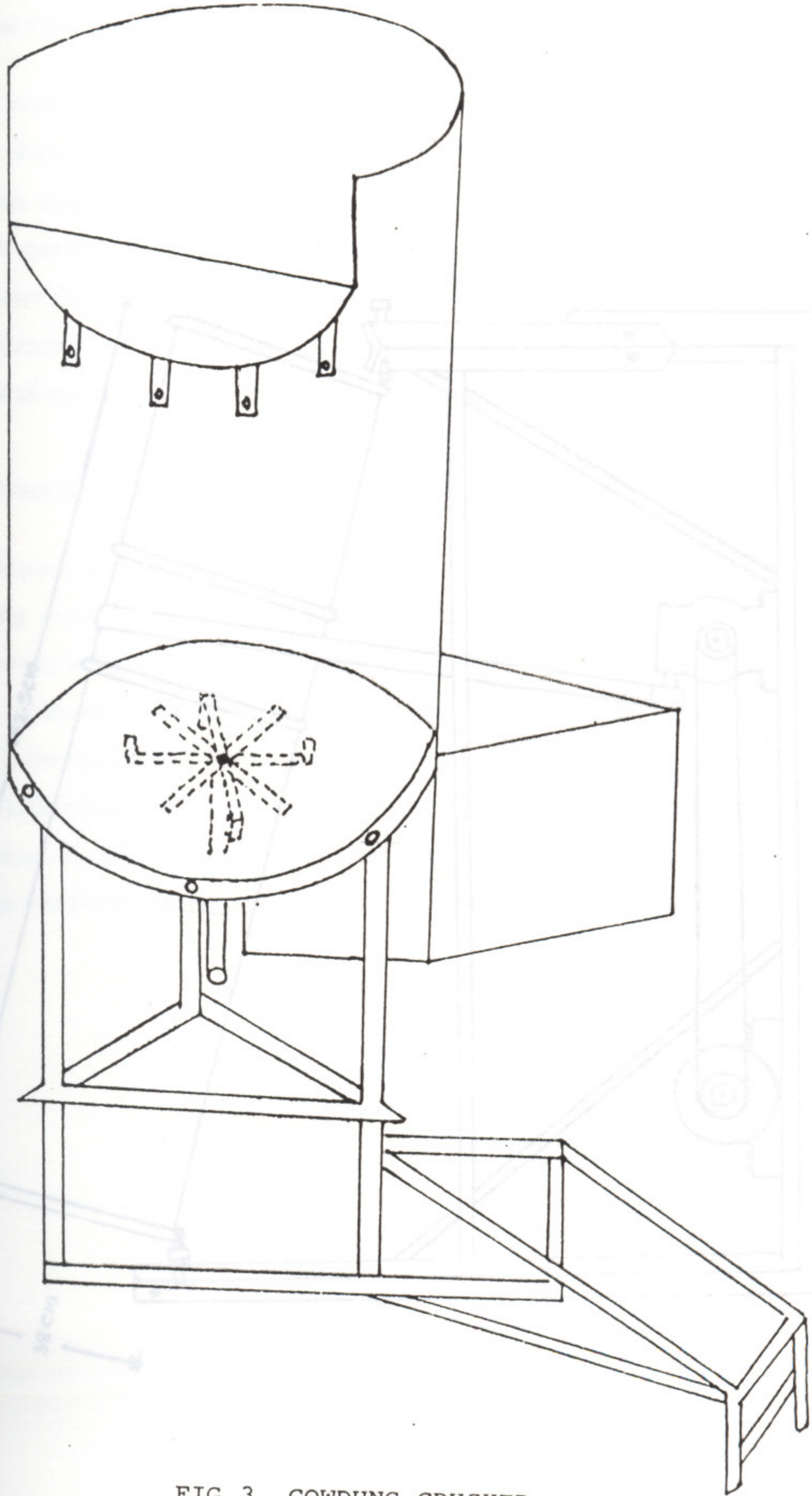


FIG.3. COWDUNG CRUSHER

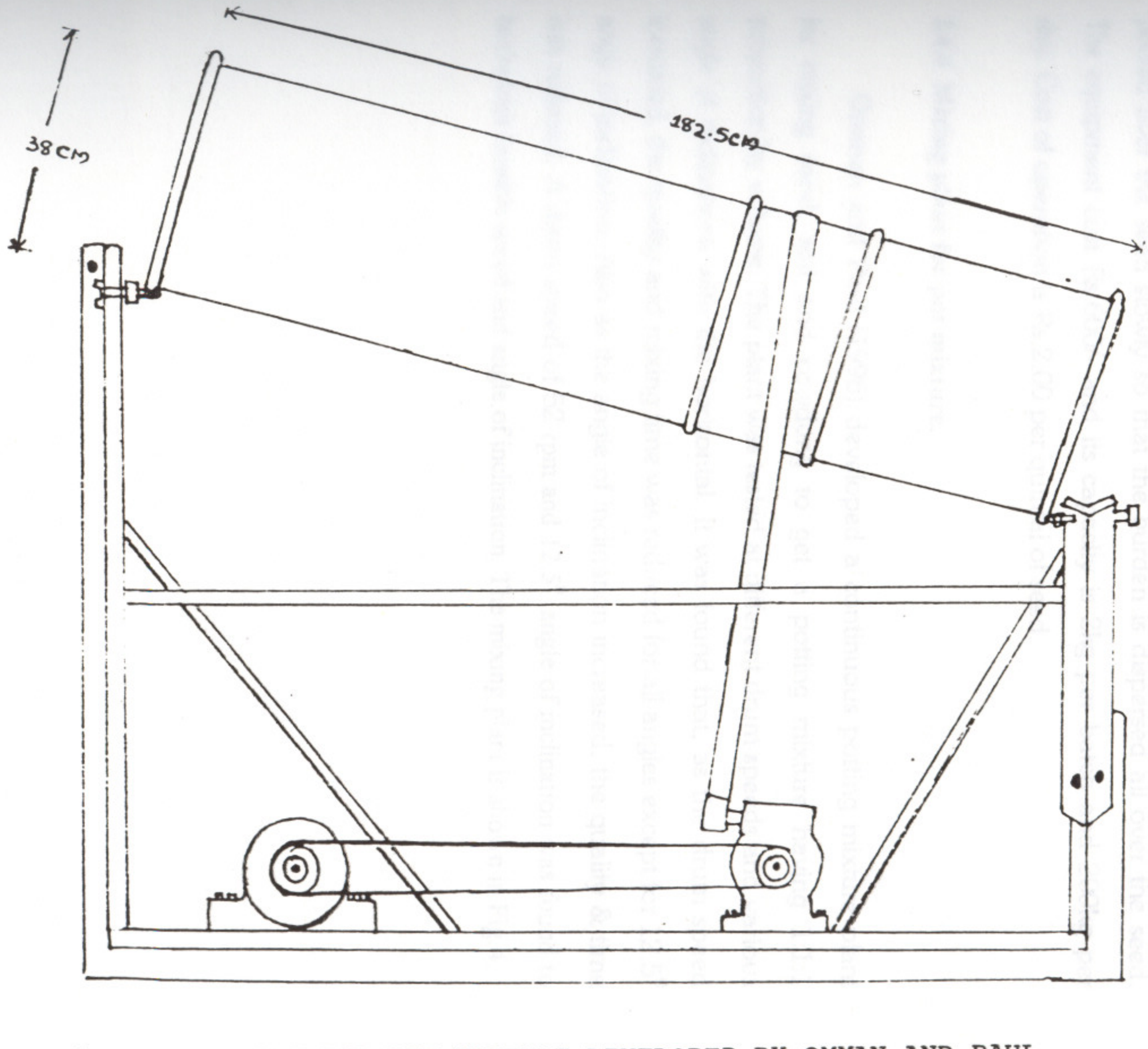


FIG.4.MIXING PLANT FOR POT MIXTURE DEVELOPED BY OMMAN AND PAUL

MATERIALS AND METHODS

This chapter describes the procedures adopted for the fabrication and testing of the mixing plant and the materials used in its fabrication.

The mixing plant mainly consists of the following six units,

1 Feeding Hopper
2 Mixing Unit
3 Collecting Device
4 Prime Mover
5 *Power Transmission Unit*
6 *Frame*

3.1 Components of mixing plant.

3.1.1 Feeding Hopper.

Excessive manual drudgery and time consumption is reduced by using a feeding hopper. Soil, Sand and Cowdung are continuously fed into three separate chambers provided in the hopper.

It is a trapezoidal feeding hopper with three individual divisions, which carries the three mixing components, namely, Soil, Sand and Cowdung. At the bottom of the hopper, there is a slit with a covering which decides the quantity of individual components flowing down into the semi - circular feeding chute. The feeding chute ends into the drum, thus ensuring complete transfer of the material into the drum.

3.1.2 Mixing Unit.

The main part of the mixing plant is the mixing unit. The mixing unit is designed such that the charge is fed into the inlet, and the mixture is discharged through the outlet continuously. The mixing unit consists of the following parts.

3.1.2.1 A drum with both sides open

The length of the drum was 182.5 cm and was made from 18 gauge MS sheet of size 6' x 4' (182.5 x 121 cm) with the help of a roller. The diameter of the drum was 38cm. Two toothed wheels of diameter 16" were welded over the drum at the ends for support and to confine the MS sheet in position. The dimensions are shown in Fig. 5 & 6 (Plate 1 & 2).

3.1.2.2 Flights.

For proper mixing of the Soil, Sand and Cowdung, it should be carried to the top of the drum and that is to be dropped just like a tumbling mill. This intermittent falling and carrying is to be repeated for a number of times before the mixture is discharged through the outlet. For satisfying this purpose, the flights are provided inside the drum and were made by welding a thin MS sheet of 152 x 9 x 0.1cm size in an MS angle iron piece of 25 x 25 x 3 mm size. For reinforcement, 25 x 3mm MS flat pieces of 8.5 cm length were welded at 18cm interval, on the angle iron such that the sheet was confined between the flat pieces and the angle iron. Such 3 flights were made and were bolted inside the drum providing equal spacing between the consecutive flights. The Flight is shown in Fig. 8 (Plate 1).

3.1.3 Collecting Device.

It is a rectangular tray of size 60 x 33 x 5 cm. It is fixed at an angle of 30^0 with the horizontal for the easy transfer of mixture to the pot.

3.1.4 Prime Mover

The prime mover of the mixing plant is an electric motor of 1 hp capacity. The specification of the motor are given in Appendix II

3.1.5 Power Transmission Unit.

The speed of the motor is 1440 rpm, but the rpm needed at the drum was below 100. Therefore, the speed should be reduced before the power reaches the drum. For this purpose a reduction gear was provided between the motor and the drum The specifications of the reduction gear are also given in Appendix II.

The motor is connected to the reduction gear by means of a V-belt drive. A 2" V-belt pulley is connected to the shaft of the motor and 3" V-pulley is connected to the input shaft of the reduction gear box. Thus we obtained a speed of 960 rpm at the input shaft of the reduction gear box from the rpm of 1440 of the motor. The reduction gear box is capable of reducing the speed in 1:10 ratio. So we obtained an rpm of 96 at the output shaft of the reduction gear box. The reduction gear box is again connected with a shaft, which drives the drum by means of a V-belt drive. Here also a reduction of speed from 96 rpm to 52 rpm is achieved. For this purpose a 6" V-pulley is connected to the output shaft the reduction gear box and a 11" V-pulley is connected to the shaft. The shaft is supported in a bearing box. A MS plate of diameter 9" is fixed at the other end of the shaft. The drive to the drum is given by four forks(bended angle iron) by bolting the same to the drum and plate as shown in fig.6. Thus the drum rotates at the same speed of the shaft.ie, at 52 rpm.

3.1.6 Frame.

The frame is made to support the Mixing Unit, Power Transmission Unit and the Prime Mover. The frame should be rigid and should be able to hold all the parts of the machine.

The drum is placed at an angle of 12.5° with the horizontal plane. The lower end of the drum is supported by 4 forks on to the 9" MS plate. The upper end of the drum has a 16" toothed wheel mounted on it which in turn is meshed with three toothed wheels on the triangular frame. The triangular frame is an equilateral triangle of length 82cm with the three toothed wheels on its vertices. The triangular frame is welded to the main frame, thus supporting the entire mixing unit. The main frame is of length 250cm and 25cm wide and is made of

35 x 35 x 5 mm and 25 x 25 x 6 mm angle iron pieces. For reinforcement , angle iron pieces and G I pipes were welded at the required position. The dimensions of the frame are shown in Fig. 5 & 7 (Plate 2 & 3). The specifications of the material used for the fabrication are given in Appendix III.

3.2 Experimental Procedure

The details of the experiment conducted on the continuous type mixing plant are described.

3.2.1 Time of Travel

The time of travel for the mixture ingradients from the feeding hopper to the collecting tray was determined. Soil, Sand and Cowdung were fed into the hopper in proportions. Time taken for reaching the first particle and the time taken for the mixture at the outlet were found. The time of travel of the particles after closing the slit and the time required for obtaining $1m^3$ of mixture was also found.

3.2.2 Capacity of the Mixing Plant

The Capacity of the plant was foundout by operating the mixing plant for fixed output.

3.2.3 Power Requirement

The Power requirement at no load and loaded conditions were found out by connecting an energymeter in the circuit. The specifications of the energymeter is given in Appendix IV.

3.2.4 Economical Analysis

Cost of operation for $1m^3$ of potting mixture were calculated for mixing plant and manual labour.

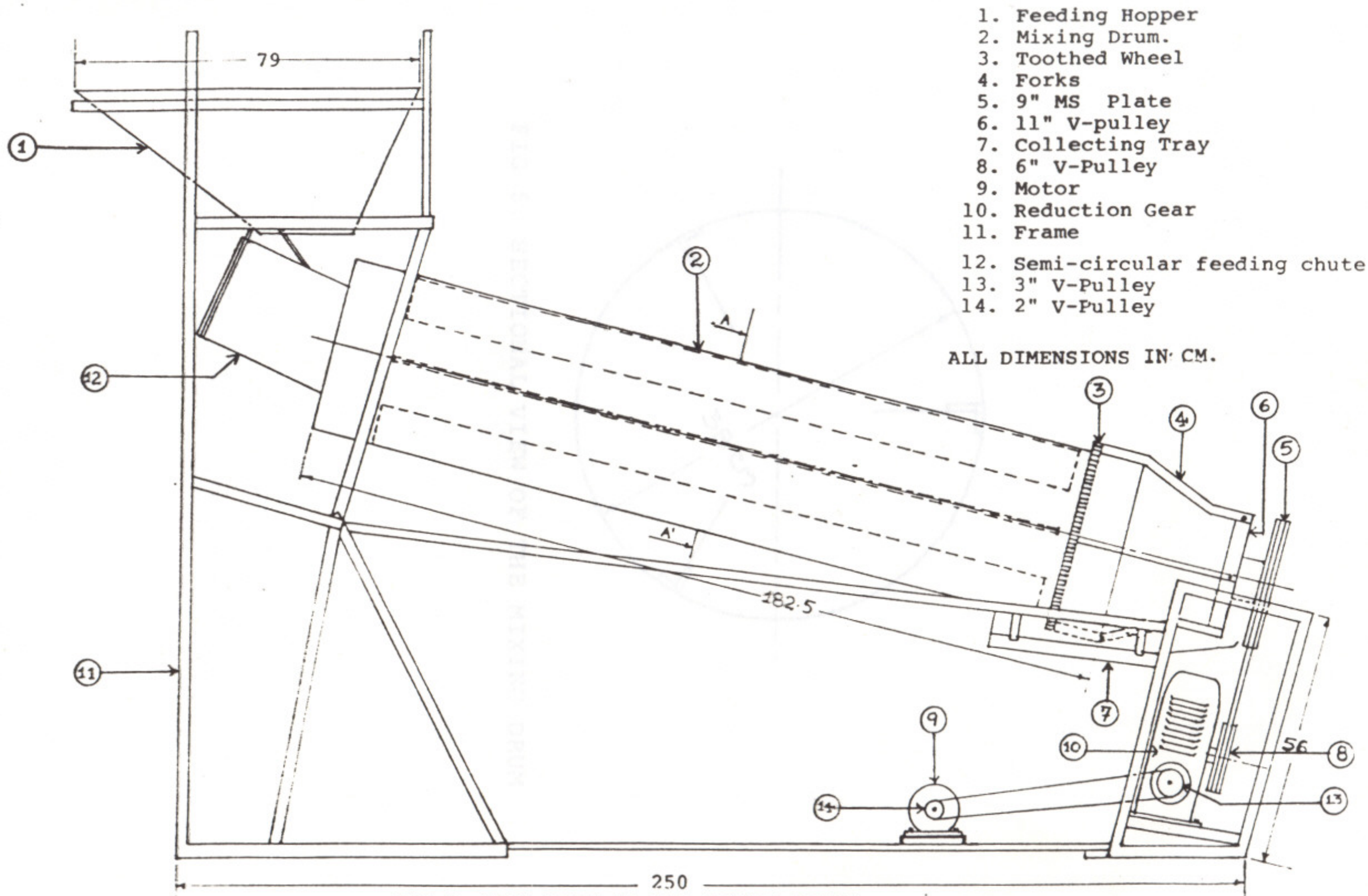


FIG.5. SIDE VIEW OF THE MIXING PLANT

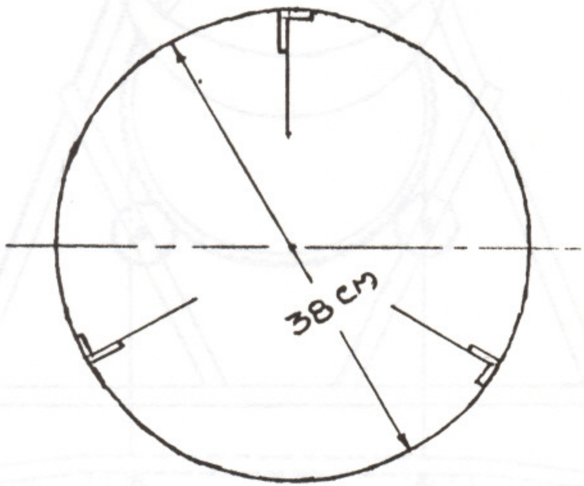
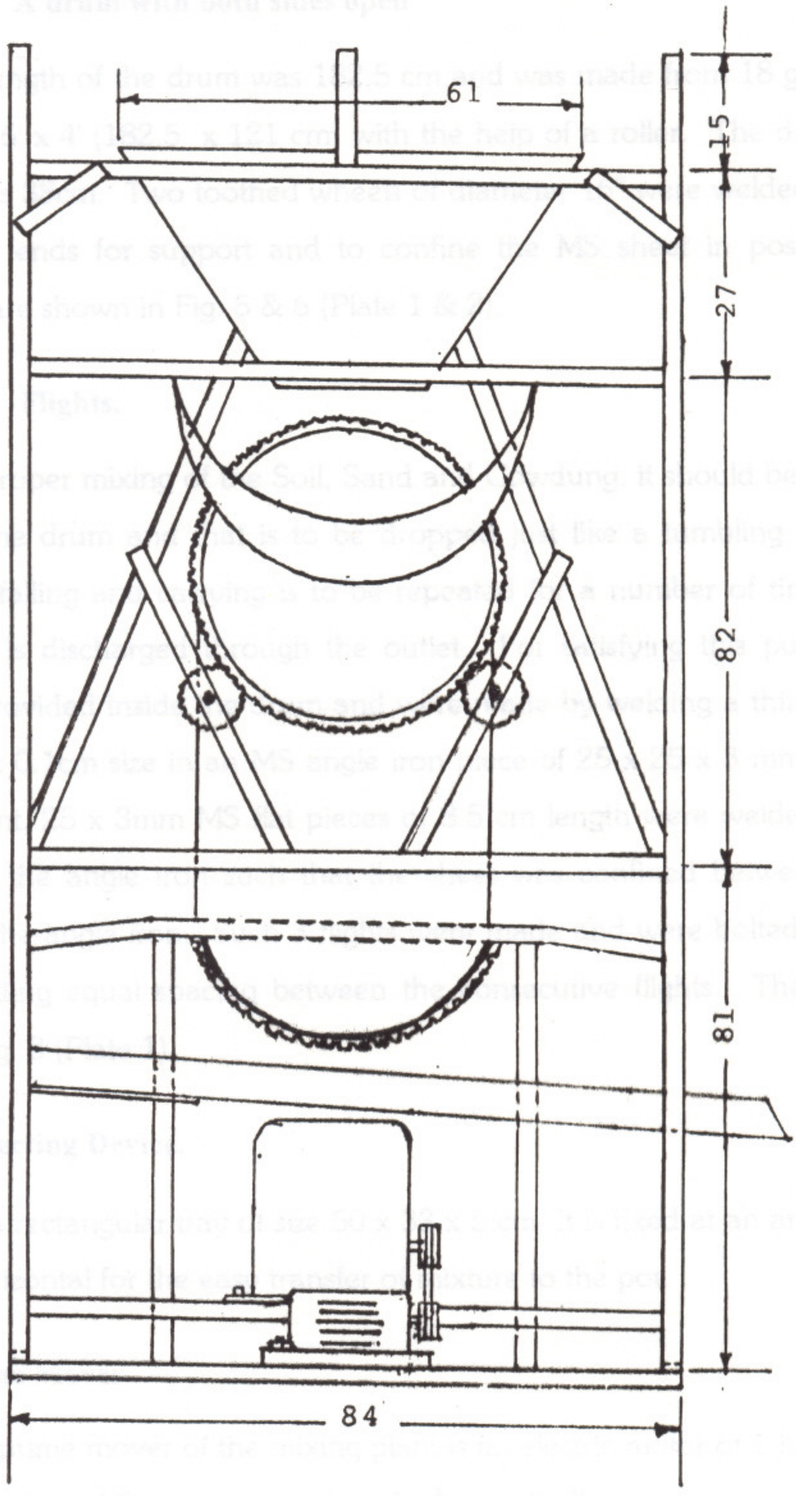


FIG 6. SECTIONAL VIEW OF THE MIXING DRUM



ALL DIMENSIONS IN CM.

FIG.7.FRONT VIEW OF THE MIXING PLANT

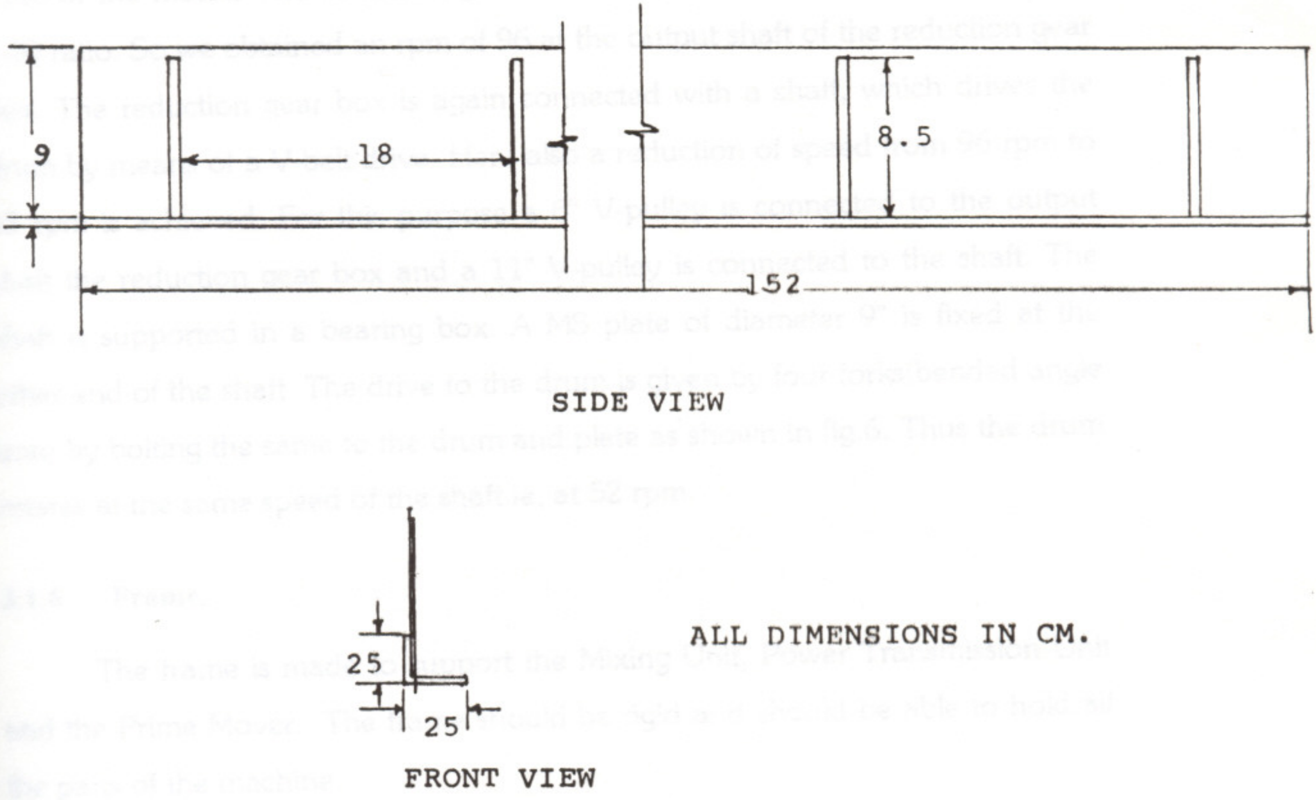
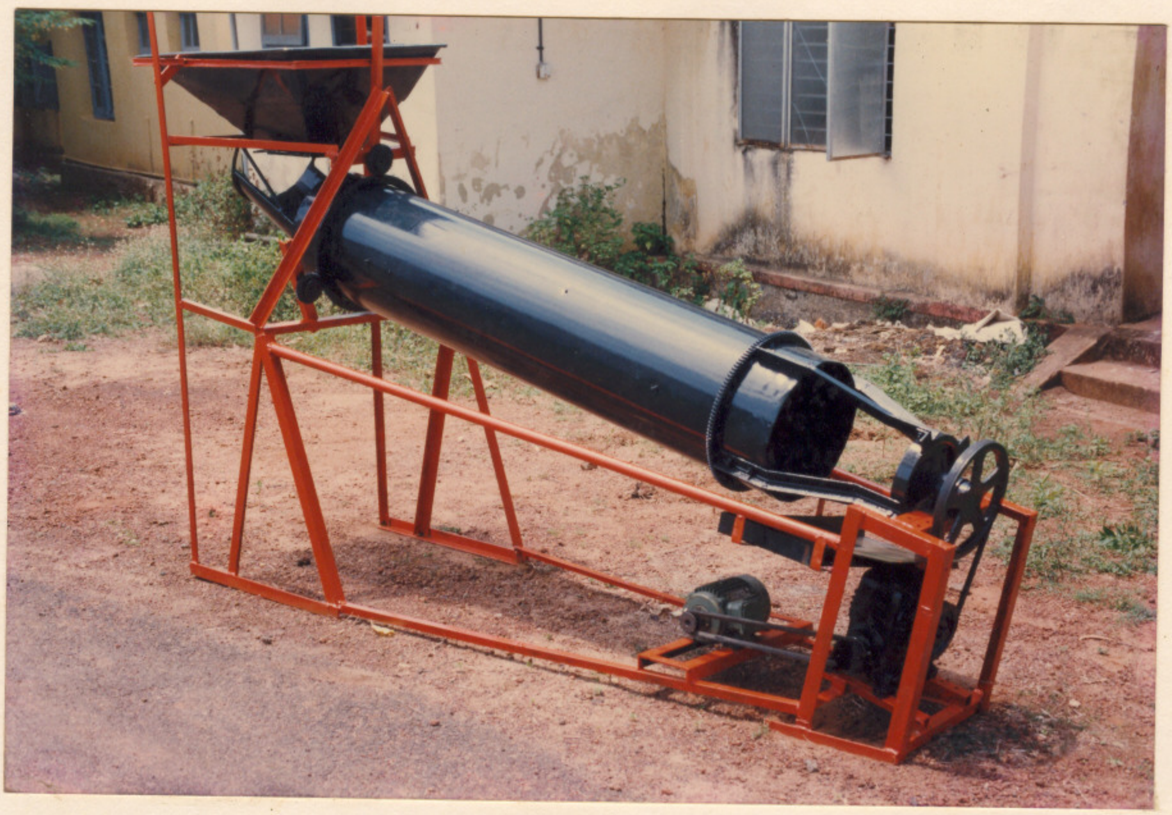


FIG 8.FLIGHTS OF THE DRUM



RESULTS AND DISCUSSION

Performance evaluation of the Mixing Plant

The perfomance of the developed mixing plant is evaluated and the results are discussed.

4.1 Time of Travel.

Soil, sand and cowdung were fed into the hopper at 1:1:1 proportion. Readings of time of travel from feeding chute to the collection tray was found. The values are tabulated in table 1. From the table, it was found that the time at which first particles and the mixture obtained were 6.33 Sec. and 13.33 Sec. respectively. Even after closing the slit of the hopper, particles were obtained for another 14.33 Sec. Also, time taken for obtaining 1m^3 of potting mixture was found to be 22 Sec.

Table 1. Time of travel and time taken for obtaining 1m^3 of pot mixture.

Trail No:	Time at which particles obtained initially.(Sec).	Mixture obtained (Sec)	Particles obtained after closing the slit.(Sec).	Time taken for obtaining 1m^3 of mixture(min).
1	6	12	14	24
2	7	14	15	20
3	6	14	14	22
Mean	6.33	13.33	14.33	22

4.2 Capacity

The amount of potting mixture obtained in an hour by manual and mechanical mixing were calculated.

From experiments, it has been found that manual labour requires 45 min.for preparing $1m^3$ of potting mixture. Therefore, in one hour $1.33m^3$ of potting mixture is obtained under similar conditions.

From table 1, the amount of potting mixture obtained during an hour of operation of the mixing plant was found to be $2.73\ m^3$. Thus the mixing plant has got twice the capacity when compared to mannual labour.

In addition, it has been found that the rate of manual work gradually decreases as time elapses (due to lethargy of labourers), but the rate of the mixing plant doesnot vary with time.

4.3 Power Requirement

Readings of time taken for 1 revloution of Energymeter disc was found and values are tabulated in Table-2. From the table, it was found that 72 Sec. and 68 Sec. were needed for 1 revolution of Energy meter disc under no load and loaded conditions. Thus the power requirement under no load and loaded conditions were found to be 0.59 hp and 0.63 hp respectively. The details of calculation of power requirement are given in Appendix V.

Table 2. Time taken for one revolution of Energymeter disc under no-load and loaded conditions

Trial No.	Time taken for 1 revolution of Energymeter disc (Sec.)	
	No Load	Loaded
1	72	69
2	71	68
3	73	67
Mean	72	68

4.4 Economical Analysis

A comparison of the cost of operation of making the potting mixutre manually and by using the mixing plant was done.

The cost of operation per m^3 of potting mixture when made manually was found to be Rs. 16.88.The details of cost of operation by manual method is given in Appendix VI.

The cost of operation per m^3 of potting mixture made by using the mixing plant was found to be Rs.5.52. The details of cost of operation are also given in AppendixVI.

Therefore, it is quite evident that the use of the mixing plant is much economical than employing manual labour.

SUMMARY AND CONCLUSION

Agriculture has been the mainstay of human being from time immemorial. Agriculture industry generally is understood to be involved in the production of various plant crops and livestock. The specialized food and ornamental plant production businesses are grouped together in the section of agriculture is known as horticulture. Fruits and vegetables occupy a prominent place in the daily diet of individuals. The exuberant prize rise of fruits and vegetables has brought the concept of backyard forming into prominence. The apt soil conditions for the growth of such plants in our backyard could only be facilitated by planting them in pots. Thus the potting mixture used in plants plays a vital role in potting and the correct proportion of the mixture, timely and efficient mixing are of atmost importance for the success of this new type small scale farming. Thus, progressive minded men have resorted to the concept of mechanical mixing due to is manifold advantages of manual mixing.

The parts of the mixing plants are the Feeding Hopper, Mixing Unit, Collecting Device, Prime Mover, Power Transmission Unit and Frame. The drum was made of 18 gauge MS sheet of 6' x 4' size with the help of a rolling machine. Inside the drum, fingers are provided as the drum rests over three toothed wheels on the upper end and over the MS plate at the lower end. The drum is placed at angle of 12.5^0 with the horizontal. The drive from a 1 hp motor was given to the drum through a reduction gear and a set of pulleys. During testing, soil, sand and cowdung where fed into the hopper and drum rotated at an rpm of 52, which was found to be most efficient from earlier studies.

Readings, namely,time taken for the travel of particle through the drum and thereby the time taken for making $1\ m^3$ of potting mixture. A comparison was made between rate of making potting mixture manually and by using the mechanical mixer. It was found that the amount of potting mixture made using the mixing plant was almost double the amount made manually in unit time.

The cost of operation by using the mechanical mixer was Rs. 5.52 per m^3 while labour charges amount Rs. 16.88 per m^3. The power requirement of the mixing plant was 0.63 hp and cost of mixing plant with motor and reduction gear was Rs.10,000/-.

Thus the mixing plant was found to be more efficient in all aspects, when compared to manual mixing.

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APPENDIX - I

Specifications of MAXINDIA and ESI Concrete Mixers.

MAXINDIA Concrete Mixer.

	Model 1	**Model 2**
Capacity	200/140 liters (7/5cft).	140/100 (5/3.5cft).
Drum Speed	20 rpm	15 to 20 rpm.
Prime mover	Air or Water Cooled Diesel Engine or Electric Motor.	Air or Water Cooled Diesel Engine or Electric Motor
Discharge height	500mm.	500mm.
Dimension	1700 x 1125 x 3160 mm	

ESI Concrete Mixer.

	Model 1	**Model 2**
Capacity (Unmixed)	7cft. 5cft.	10 cft.
Capacity (mixed)	5 cft. 3.5cft.	7cft.
Drum speed	18/20 rpm.	18/20 rpm.
Power	HSD Diesel Engine / Motor.	HSD Diesel Engine / Motor
Type	Tilting.	Tilting
Loading	Hand Loading.	Hopper Loading.

APPENDIX - II

Specifications of Prime Mover and Reduction Gear.

Motor.

Excelsior	-	Three Phase, AC Motor
Power	-	1hp
Voltage	-	400 / 440
Current	-	1.9 A
Frequency	-	50 Hz

Reduction Gear.

Tecon worm gear unit
Model - UFR
Ratio - 10:1

APPENDIX - III

Materials used for the fabrication of Pot Mixer.

1	MS sheet	18 guage	--	6' x 4'
2	Angle iron	17 x 17 x 5 mm	--	10 m
		30 x 30 x 6 mm	--	12 m
3	V - belt	47 cm long	--	1 No.
	V - belt	52 cm long	--	1 No.
4	V - belt pulley	2"	--	1 No.
	V - belt pulley	3"	--	1 No.
	V - belt pulley	6"	--	1 No.
	V - belt pulley	11"	--	1 No.
5	M S plate	9"	--	1 No.
6	G I pipe	1 ½"	--	4 m

APPENDIX V

Power Requirement

No-load Condition

From Energymeter Specification,
112.5 revolution of Energymeter disc = 1 Kwh

From Table 2,
Time taken for 1 revolution of the Energymeter disc = 72 Sec.

No. of revolutions in an hour $= \frac{3600}{72}$

$= 50$

Energy requirement to operate the machine in an hour $= \frac{50}{112.5}$

$= \underline{0.44 \text{ Kwh}}$

Power Requirement $= \frac{0.44}{1}$

$= 0.44 \text{ Kw}$

$= \frac{0.44}{0.746}$

$= \underline{0.59 \text{ hp}}$

Loaded Condition

From Table 2,

Time taken for 1 revolution of the Energymeter disc = 68 Sec.

No. of revolutions in an hour $= \frac{3600}{68}$

$= 52.94$

Energy requirement to operate the machine in an hour $= \frac{52.94}{112.5}$

$= \underline{0.47 \text{ Kwh}}$

Power Requirement $= \frac{0.47}{1}$

$= 0.47 \text{ Kw}$

$= \frac{0.47}{0.746}$

$= \underline{0.63 \text{ hp}}$

APPENDIX VI

Cost of Operation

Mixing Plant

Cost of the Mixing Plant with motor and reduction gear = Rs. 10,000/-

Annual Use = 500 hrs

Fixed Cost

Depreciation : Assuming a useful life of 10 years and a salvage value of 10%

Depreciation $= \dfrac{10{,}000 - 1000}{10}$ = Rs. 900/-

Interest @ 12% $= \dfrac{10{,}000 + 1000}{2} \times 0.12$ = Rs. 660/-

Tanes, insurance and shelter @ 2% of the initial cost = $0.02 \times 10{,}000$ = Rs.200/-

Total fixed cost per year = Rs.1760/-

Fixed Cost per hour $= \dfrac{1760}{500}$ = Rs. 3.52 /hr.

Operating Cost

Repairs at the rate of 5% of initial cost $= 10{,}000 \times \dfrac{5}{100}$ = 500/ year

$= \dfrac{500}{500}$ = Rs. 1/ hr.

Cost of power @ Rs. 1.10/Kw $= 0.5 \times 1.10$ = Rs. 0.55/ hr.

One woman labour is required to feed the charge

Labour cost @ Rs. 80/day = 80/8 = Rs. 10/ hr.
Total operating cost = Rs. 15.07/hr.

Feed rate = 2.73 m^3/hr

Total cost per m^3 of potting mixture $= \dfrac{15.07}{2.73}$ = Rs. 5.52

Manual Labour

No. of labours engaged : One man and One woman.

Wages for the labours = 100+80 = Rs. 180/-

Time taken to fill 1 m3 of potting mixture = 45 minutes (from experiments)

Volume of mixture produced in a day of 8 hrs = $\frac{8 \times 60}{45} = 10.67 m^3$

Total cost per m^3 of potting mixture = $\frac{180}{10.67}$ = <u>Rs.16.88</u>

DEVELOPMENT AND TESTING OF A CONTINUOUS MIXING PLANT FOR POT MIXTURE

By

ANI. S. T.

ABSTRACT OF THE PROJECT REPORT

Submitted in partial fulfilment of the
requirement for the degree

Bachelor of Technology
in
Agricultural Engineering

Faculty of Agricultural Engineering
KERALA AGRICULTURAL UNIVERSITY

Department of Farm Power Machinery and Energy
KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
TAVANUR - 679573, MALAPPURAM.

1997

ABSTRACT

A continuous potting mixture plant for mixing sand, soil and cowdung to get a potting mixture having 1:1:1 proportion by volume of the above mentioned 3 constituents, was fabricated at K.C.A.E.T, Tavanur. The plant was tested to find the rate of production of potting mixture and the cost of operation.. The rate of producing potting mixture mechanically in unit time was double the amount produced manually. The cost of operation was only $1/3^{rd}$ in comparision to that of manual mixing. Thus the mixing plant was found to be twice as efficient when compared to manual mixing.