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DETAILED FEASIBILITY REPORT

(PROJECT FEASIBILITY REPORT)

O N

BABY CORN

INDENTIFICATION & EVALUATION DIVISION FOR HI-TECH PROJECTS

ENGINEERS INDIA RESEARCH INSTITUTE

E I R I C O N S U L T A N T S & E N G I N E E R S

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C A U T I O N

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(EIRI/DFR/0394) (J.C. MANUAL)

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BABY CORN

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INTRODUCTION

Baby corn is a unique cereal with a difference of value addition in terms of milky tender cob as a fresh natural food cum vegetable. The tender cobs are consumed as such as a natural food. It is very tasty, sweer and easy to consume because of its tenderness and sweetness with nutritive value addition. Added to this, it can be used as a vegetable in daily culinary preparations and for preparing delicacies for special occasions. Cultivation of baby corn generates employment for the rural poor since, 3-4 crops can be raised in an year. it occupies an important place in the food processing industry of India. The economic potential and marketing aspects of canning baby corn as a small scale food processing venture can be explored. Canning and pickling industries of baby corn offer huge export potential. Demand for baby corn as a health food is increasing in class hotels and middle class consumers. After the harvest of babies, the economic potential is further enhanced since it supplies green, soft, succulent, nutritious, palatable fodder with higher digestibility.

USES OF BABY CORN

* Eaten afresh directly

* Used as a vegetable

* In the preparation of salads, soups, appetizers, chowders, stews and fried dishes.

* Canned

* Preparation of pickles- Tamarind baby corn pickle, baby corn masala pickle, baby corn sweet hot pickle and mixed vegetable pickle.

* Baby corn Manchurian and chilly baby corn preparations.

* It is used in poriyal, kurma, kuzhambu and butter milk kuzhambu.

* It is a part of delicacies such as milk payasam, alwa bajji, pakoda, biriyani and curd pachadi.

* Its green nutritious, palatable fodder is fed directly to cattle or ensiled.

NUTRITIVE VALUE OF BABY CORN (ON DRY WEIGHT BASIS)

Protein	:	15-18%
Sugar	:	0.016-0.020%
Phosphorus	:	0.6 - 0.9%
Potassium	:	2-3%
Fibre	:	3-5%
Calcium	:	0.3-0.5%
Ascorbic acid	:	75-80 mg. 100g

In addition, it is a rich source of rhiamine, riboflavin and folic acid and it is an attractive low calorie vegetable high in fibre without cholesterol.

SCOPE FOR CULTIVATION OF BABY CORN

* In traditional belt and malnad areas in place of upland rice where water is insufficient for paddy crop.

* Irrigated areas

* In the traditional rainfed maize areas which suffers due to vagaries of monsoon baby corn is a best alternate dual purpose crop by virtue of short duration (65-75 days).

* In North-Eastern Indogangetic plains of Bihar, UP, Karnataka and Andhra Pradesh.

* In traditional sorghum areas in place of late sown jowar which is likely to be infested with shoot fly in the early stage and ear head midge at the later stages.

* During rubi season in rice fallows with residual moisture.

* In place of fodder maize for both baby corn and green fodder.

* In a double cropping system as an early crop with protective irrigation followed by a regular crop.

* Baby corn will be a solution to the vegetable needs of the increasing population and to the innovative thinking of enthusiastic farmer who want to have commercialized agricultural wealth scenario.

Quality of baby corn as measured at the international level tandard

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Ear length	:	4-9 cm
Ear diameter	:	1-1.5 cm
Ear colour	:	Cream yellow
Ovule arrangement	:	Regular

Local food processors grade baby corn

Super small	:	3 cm
Small	:	3-6 cm
Medium	:	6-9 cm
Large	:	9-11 cm
Extra large	:	>11cm

* While measuring diameter, basal, mid and tip are considered

* Number of rows and Number of columns in baby corn is also considered by food processors.

* Rejection must be less than 10% in any hybrid.

* Rejection includes long cobs, grain, filled cobs, different shapes of cobs.

* Stage of harvest play an important role in reducing the rejection per cent.

Problems associated with the Baby corn production in India

* Lack of knowledge about this potential dual purpose crop

* In appropriate genotypes and

* Lack of improved agro techniques.

Cultivation of baby corn in India leads to

* Maize diversification

* Value addition as a health food and foreign exchange earner

* Growth of food processing small scale industries and

* Generation of gainful employment to rural poor since, it is possible to rais 3 to 4 crops of baby corn in a year depending on the Agro-climatic conditions.

CLIMATIC REQUIREMENTS AND SEASONS

Climatic requirements

Baby corn an offshoor of maize is suited to tropical and subtropical climate. In areas receiving seasonal rainfall of 400 mm or more well distributed for 2 1/2 months, baby corn can be successfully raised. Growing season temperature of 21 to 32oC is most desirable. It can be cultivated in all the three seasons provided minimum temperature does not go below 15oC and irrigation facilities are available during summer.

Seasons

Although baby corn can be grown round the year, the optimum time of sowing is June-July in Kharif, September-October in rabi and January-February during summer seasons.

Soil Requirement

Baby Corn is grown in all type of soils. The ideal soil type would be well drained sandy loam to silty loam soils. Water stagnation is harmful to the crop. Therefore, proper drainage is mandatory for the success of the crop especially during Kharif season. Baby corn will not thrive on heavy clays especially low lands. It can be grown successfully in soils with pH ranges from 5.5 to 7.5.

Land Preparation

Baby corn needs a friable, well aerated, moist and weed free seed bed, so that the seed placed at a depth should come in contact with soil particles to ensure sufficient movement of moisture to the seed. The first ploughing should be done with soil inverting plough so that at least 20-25 cm deep soil may become loose followed by two to three harrowing or intercrossing ploughing with local plough. Planking should be done after harrowing. A properly levelled and uniformly graded field is a pre-requisite for good water management and drainage. Application of about 10 tons of Farm Yard manure per ha before last ploughing is essential.

SELECTION OF SUITABLE VARIETY

Selection criteria for baby corn production differs from grain to sweet corn.

* Each plant bears multiple babies to realize higher yield
* Babies should emerge in sequence to facilitate multiple harvests
* Sturdy stalk resistant to breakage when multiple harvests are done
* Babies should be long and slender
* The wrapper husk should provide protection to the baby during handling and storage.

Characteristics of cultivars selected for Baby Corn Production

Cultivars	Stalk type	Harvest	Mature ear shape/1 X d (cm)	Smut resistance
Golden hybrid	Sturdy	Easy	Slender/20 x 4	Yes
Sugar loaf	Fragile	Easy	Slight taper/20x4	Yes
Kiss-n-Tell	Fragile	Difficult	Cylindrical/1 x4	No
Robust-41-10	Sturdy	Easy	Slender26x5	yes
Fiesta	Sturdy	Difficult	Slender/26x4	No
How sweet it is	Fragile	Difficult	Slender/22x5	No
Matinee	Sturdy	Easy	Cylindrical/18x4	Yes
Pop white	Fragile	Easy	Cylindrical20x4	Yes
Carousel	Fragile	Difficult	Stubby/10x5	Yes
White cloud	Sturdy	Difficult	Cylindrical 13x4	Yes
Sweet (R) 82	Sturdy	Easy	Tapered/22x5	No

In India, development and release of baby corn variety or hybrid is of recent origin in the maize diversification process. At the Vivekananda Parvatiya Krishi Anusandhana Sansthan, Almora seven yellow flint grain maize varieties were developed and released for commercial cultivation in the North-Western hills of India. Among these early duration double cross hybrid VL-42 produced the highest baby corn yield (1,428 kg ha-1) with an average of more than one baby per plant. It was earliest in maturity (45 days). The babies of this variety were cylindrical, longer, uniform and more attractive. Recently the Directorate of Maize Research, New Delhi identified VL-42 and MEH-44 for baby corn production at the national level. Composite VL-16 is another suitable variety for baby corn production with potential yield of 1102 kg ha-1 in 49 days.

Baby corn of different maize varieties

Variety	Yield (kg ha-1)
VL-16	1102
VL-41	1031
VL-42	1428
VL-78	971
VL-88	1048
VL Amber Pop Corn	846
Dhari Local	819

Results of the studies conducted at Himachal Pradesh Krishi Vishwavidyalaya, Regional Research Station, Bajaure of All India Coordinated Maize Improvement programme revealed the suitability of 4 cultivars viz., hybrids "VL-42, MEH-114, MEH-133" and a composite, 'Early composite' for baby corn production.

Man yield and agronomic characteristics of maize cultivars for baby corn production

Cultivars	Yield (kg.ha-1) With husk	Yield (kg.ha-1) Without husk	Green fodder yield (t.h-1	Size of young cob (cm) With husk Length	Size of young cob (cm) With husk Diameter	Size of young cob (cm) Without husk Length	Size of young cob (cm) Without husk Diameter	Cobs plant-1	Days to harvest	Period of harvest (Days)
VL-42	091	1913	24.9	16.8	1.53	8.2	1.20	2.68	48	19
MEH-133	8797	1744	30.9	17.0	1.70	8.6	1.16	2.31	54	22
MEH-114	8292	1720	31.1	17.1	1.70	8.6	1.16	2.28	54	22
Early Composite	7884	1512	39.8	18.8	1.74	9.3	1.18	1.86	58	21
CD (p=0.05)	245	190	26	-	-	-	-	0.40	28	NS

The results of the study conducted indicated significantly higher baby corn yield of 37.85 q ha-1 with YBC-705 compared to 25.90 qha-1 with C-6 and 21.48 q ha-1 with ITC-ZENECA.

At the Department of Agronomy, University of Agricultural Sciences, GVK, Bangalore a grain maize hybrid "Pro Agro 4642", composite"Shakthi" and three baby corn hybrids "Golden baby, PAC-792 and PAC-793" were evaluated for their performance of baby corn production. The Agronomic characteristics of these cultivars in relation to baby corn.

The results indicated the superiority of PAC-792, PAC-793, composite and grain maize hybrid in terms of dehusked baby corn and green fodder yield compared to golden baby. This may work well when the produce is bulked for marketing. But when grading and labeling is done, the preference of the consumer is certainly for baby corn hybrid.

Mean yield and agronomic characteristics of maize/baby corn cultivars for baby corn production

Cultivars	Yield(kg ha-1) Green fodder			Size of baby (cm)				Babies plant-1	Days to harvest	Period of harvest (Days)
	With husk	Without husk	yield (t ha-1)	With husk		Without husk				
				Length	Girth	Length	Girth			
Golden baby	9423	1803	17.55	23.31	8.71	10.39	6.45	2.1	41	8
PAC 792	8862	2571	29.90	19.91	7.47	10.39	5.06	1.87	48	10
PAC 793	1048	2213	47.36	21.50	7.52	8.35	4.89	2.52	48	10
Pro-Agro 4642	9740	2195	34.50	21.05	7.85	10.00	5.57	2.67	50	10
Composite (Shakti)	10159	2559	27.26	21.24	7.86	10.13	5.33	3.75	50	10

Golden baby PAC-792 is graded the best for characters like appearance, colour, texture, taste and juiciness followed by composite for appearance, texture and taste. Where as maize hybrid ranked second with respect to colour and juiciness. Golden baby/ PAC-792 is the best choice of consumer with respect to quality.

Sensory parameters as influenced by varieties in baby corn.

Varieties	Appearance	Colour	Texture	Taste	Juiciness
Golden baby / PAC 792	4.07	3.98	4.04	3.37	3.56
Hybrid maize	3.53	3.54	3.24	2.80	3.02
Composite	3.70	3.43	3.48	3.10	2.85

The results of the nutritional parameters indicated that both Hybrid maize and composite were found to contain higher percentage of sugar (0.025 and 0.022 per cent respectively) and potassium (3.05 and 2.93 per cent respectively) as compared to Golden baby/PAC792. While, Golden baby/PAC-792 and Hybrid maize contained higher percentages of protein (14.67 and 15.28 respectively) and phosphorus (0.81 and 0.77 respectively) as compared to protein (13.33) and phosphorus (0.75) content of composite variety. In case of calcium and fibre content, composite (0.34 and 4.67 per cent respectively) and Golden baby/PAC-792 (0.33 and 4.57 per cent respectively) were found to be superior as compared to Hybrid maize.

Sugar, protein, phosphorus, potassium, calcium and fibre content as influenced by varieties.

Varieties	Sugar (%)	Protein (%)	Phosphorus (%)	Potassium(%)	Calcium (%)	Fibre (%)
Golden baby/ PAC-792	0.015	14.67	0.81	2.90	0.33	4.57
Pro-Agro 4642	0.025	15.28	0.77	3.05	0.30	4.47
Composite	0.022	13.33	0.75	2.93	0.34	4.67

SEED RATE AND PLANT POPULATION

Seed rate

To maintain the desirable popularation of baby corn ten to twenty per cent more seeds are required to compensate for various field losses and reduced germination. Based on the seed weight and the required plant population per hectare thenormal seed rate required is 35-40 kg per hectare for hybrids to maintain two plants per hill.

Optimum Plant Population

The yield of baby corn depends to a great extent on the number of plants per unit area. It is of great importance to establish the optimum plant population for the region concerned, because unlike tillering plans such as rice or wheat, baby corn can not compensate for lost space. The number of plants per unit area depends on the variety, its duration, productivity of soil and the water supply.

Earlier study by revealed the yield level of 29.62 qha-1 with 45x30 cm spacing which was 11.06 per cent higher compared to 45 x 15 spacing.

The results of the experiment have indicated that 60 x 20 cm, 45 x 20 cm and 45 x 30 cm spacing recorded higher husked babies (95.06, 91.65 and 87.02 q ha-1 respectively) and dehusked babies (20.05, 1.39 and 18.41 q ha-1 respectively) and fodder yield (36.45, 39.03 and 34.23 t ha-1 respectively) as compared to 60x30 cm spacing (84.36, 17.85 q ha-1 and 31.7 t ha-1 of husked, dehusked and fodder yield respectively).

Baby corn production requires Detasseling and harvesting of babies. Detasseling has to be done as soon as the emergence of tassel and before it sheds pollens. This continues for about 5-6 days and harvesting of babies involves 8-10 pickings since all plants do not produce babies simultaneously and each plant produces on an average of 2-3 babies. It is economical to plant baby corn at 60x20 cm (83,333 hills ha-1) or 45x20 cm (I,II,III hills ha-1) spacings.

Husked, dehusked and fodder yield of baby corn as influenced by spacing.

Spacing (cm)	Plant population	Husked yield (q ha-1)	Dehusked yield (q ha-1)	Fodder yield (t ha-1)
45 x20	1,11,111	91.65	19.39	39.03
45 x 30	74.074	87.02	18.41	34.23
60 x 20	83,333	95.06	20.05	36.45
60 x 30	55,555	84.36	17.85	31.70

The sensory evaluation indicated the superiority of the 45x30 cm spacing in terms of colour (4.17), taste (3.84), juiciness (4.00), texture (4.00) and appearance (3.84) compared to other spacings. However, optimum sensory parameters were observed with 45 x 20 or 60 x 20 cm spacings.

Sensory parameters as influenced by spacing in baby corn

Spacing (cm)	Colour	Taste	Juiciness	Texture	Appearance
45 x 20	3.42	3.42	3.66	3.83	3.42
45 x 30	4.17	3.84	4.00	4.00	3.84
60 x 20	3.42	3.59	3.59	3.50	3.42
60 x 30	3.17	3.59	3.17	2.84	3.17

The nutritional parameters indicated that wider spacing of 60x30 cm recorded higher values of calcium (0.46%), sugar (0.014%), ascorbic acid (94 mg 100 g-1), protein (17.57%) and fibre (5.93%) but the optimum quality babies can be realized with 45 x 20 cm or 60 x 20 cm spacing.

Phosphorus, potassium, calciu, sugar, ascorbic acid, protein and fibre as influenced by spacing in baby corn

Spacing (cm)	Phosphorus (%)	Potassium (%)	Calcium (%)	Sugar (%)	Ascorbic acid (mg 100g-1)	Protein (%)	Fibre (%)
45x20	1.35	3.77	0.34	0.013	75	14.87	5.80
45x30	1.21	3.70	0.39	0.012	94	15.60	6.00
60x20	1.17	3.96	0.37	0.013	94	16.48	5.90
60x30	1.18	3.76	0.46	0.014	94	17.57	5.93

PLANTING METHOD (PROCESS)

Baby corn is sown at a depth of 3-5 cm. The planting depth to a considerable extent will depend on the moisture status of the field and the type of soil. If the soil is dry and sandy, it would be advisable to plant deeper. Usually planting is done by one of the following methods.

(a) Planting on the side of the ridge: This method adopted in high rainfall situations and on land not uniform.

(b) Planting in narrow furrows: This method is adopted in low rainfall areas.

(c) Planting in a flat bed with no earthing up: in normal conditions.

(d) Planting on flat bed and earthing up after 30 days of planting: In areas where there are heavy storms during rainy season.

(e) Row Direction: Planting in North-South Direction will have better light interception and enhanced growth and yield than planting in East-West direction.

NUMBER OF PLANTS PER HILL

Baby corn is harvested at the emergence of silk. It can prove well with high plant population. But, increasing plant population by reducing spacing would be inconvenient for detasseling and harvesting. Hence increasing the number of plants per hill is a better option in realizing higher baby corn and fodder yield. In this regard the experiment conducted under ICAR ad-hoc project at Bangalore revealed that the maintenance of two plants per hill produced superior husked (94.78 q ha-1), dehusked (20.03 q ha-1) and fodder yield (38.67 t ha-1) as compared to single plants per hill (84.27, 17.82 q ha-1 respectively). The increase was by 12.47% and 20.65% respectively over single plant per hill.

Husked, dehusked and fodder yield of baby corn as influenced by number of plants per hill in baby corn

Number plants per hill	Husked yield (q ha-1)	Dehusked yield (q ha-1)	Fodder yield (t ha-1)
One	84.27	17.82	32.05
Two	94.78	2.03	38.67

With respect to sensory parameters, two plants per hill graded the best for its characters like colour (3.67), texture (3.70) and appearance (3.50) as compared to single plant per hill (3.42,3.37 and 3.41 respectively) while, single plant per hill was judged best in terms of taste (3.66) and juiciness (3.70).

Sensory parameters as influenced by number of plants per hill in baby corn.

Number of plants per hill	Colour	Taste	Juiciness	Texture	Appearance
One	3.42	3.66	3.70	3.37	3.41
Two	3.67	3.54	3.50	3.70	3.50

The results of the nutritional analysis revealed that single plant per hill recorded higher phosphorus (1.24%), potassium (3.83%) and fibre (5.93%) content as compared to two plants per hill (1.21, 3.77 and 5.88% respectively). Two plants per hill was found to be superior in terms of ascorbic acid (90.6 mg 100g-1) and protein (16.26%) as compared to single plant per hill (87.5 mg 100g-1 and 16.00% respectively).

Phosphorus, potassium, calcium, sugar, ascorbic acid, protein and fibre as influenced by number of plants per hill in baby corn

No. of plants per hill	Phosphorus (%)	Potassium (%)	Calcium (%)	Sugar (%)	Ascorbic acid (mg 100g-1)	Protein (%)	Fibre (%)
One	1.24	3.83	0.39	0.013	87.5	16.00	5.93
Two	1.21	3.77	0.39	0.013	90.6	16.26	5.88

FERTILIZER MANAGEMENT

Fertilizer management plays an important role in the baby corn cultivation. Hybrids and composite varieties exhibit their full yield potential only when supplied with adequate quantities of nutrients at proper time . The time of fertilizer application is as much important as the quantity applied. As far as nitrogen is concerned, major part of the nitrogen uptake by the crop is over by the tasseling stage. In general it would be better to apply the total quantity of P and K and half of N at planting and remaining half of N at knee high stage (above 30 days after planting). The extra quantity of the fertilizer that needs to be applied to the soil will depend not only on the plant requirement of individual nutrient but also on how much of it the soil can supply. In this regard the findings of the experiment conducted under ICAR ad-hoc project at Bangalore.

Yield and returns as influenced by fertility levels in baby corn

Fertility levels (kg NPK ha-1	Husked yield (q ha-1)	No.of babies plant	Fodder yield (t ha)	Cost of cultivation (Rs. ha)	Gross return (Rs.Ha-1)	Net returns	B.C. ratio
100:50.27	63.30	1.88	35.86	2028	68570	47642	1:2.27
150:75:40+10t FYM	82.40	2.14	40.26	24944	86050	61106	1:2.45
200:190:53	85.17	2.22	42.37	23154	89321	66167	1:2.86
200:100:53 + 10tFYM	85.78	2.3	43.16	26054	90204	64150	1:2.46
CD at 5%	3.24	0.16	4.03	-	-	-	-

The scnsory parameters indicated the superiority of the 150:75:40 kg NPK ha-1 + 10 t FYM fertility levels in terms of appearance (3.92), colour (3.72), texture (3.92), taste (4.18) and juicines (3.65) followed by 200:10:53 kg NPK ha-1 and 200:100:50 kg NPK ha-1 +10 t FYM fertility levels.

Sensory parameters of baby corn as influenced by fertility levels at harvest.

Fertility levels (kg NPK ha-1)	Appearance	Colour	Texture	Taste	Juiciness
100:50:27	3.47	3.38	3.46	3.37	2.87
150:75:40 + 10 t FYM	3.92	3.72	3.92	4.18	3.65
200:100:53	3.60	3.38	3.92	3.96	3.62
200:100:53 + 10 t FYM	3.52	3.60	3.75	3.70	3.26

The nutritional parameters revealed that fertility levels of 150:75:40 kg NPK ha-1 + 10 t FYM was found to be optimum in terms of protein (19.94%), phosphorus (0.84%), potassium (2.78%), calcium (0.58%), sugars (0.015%), ascorbic acid (75 mg 100 g-1) and crude fibre (5.22%)as compared to higher doses.

Nutritional parameters of baby corn as influenced by fertility levels

Fertility levels (kg NPK ha-1)	Protein (%)	Phosphorus (%)	Potassium (%)	Calcium (%)	Sugars (%)	Ascorbic acid (mg 100g-1)	Crude fibre (%)
100:50:27	16.59	0.55	2.53	0.52	0.014	74	4.80
150:75:40+10 t FYM	19.94	0.84	2.78	0.58	0.015	75	5.22
200:100:53	19.86	0.84	2.88	0.55	0.015	76	5.27
200:100:53 + 10t FYM	19.96	0.81	2.81	0.54	0.016	77	5.32

IRRIGATION MANAGEMENT

Nature and importance of irrigation management

Water management of baby corn is an important aspect for higher production. Traditional crop of maize is greatly affected by vagaries of weather conditions. Rainfall is uncertain and may either cause prolonged drought or waterlogged conditions. It is therefore essential to consider both the aspects.

Water requirement to produce one kg of dry matter is the lowest in case of maize. Thus, a very high water use efficiency can be achieved as compared to other cereal crops. Although maize needs less water than soybean or pea its water requirement for germination is 10 to 30 times more than that of wheat, berseem and mustard. It is therefore imperative that at the time of germination available moisture in case of baby corn should be high so that each and every seed may germinate properly. Availability of moisture at later stage has direct bearing on the growth and yield of baby corn.

Methods of Irrigation

Various methods of irrigation to be adapted to baby corn depends on soil type, climate, source and head of available water resource etc. The objective of selecting a particular irrigation method is to use minimum water to get optimum yield.

i) Surface method: In this surface system water flows by gravity either through furrows, basins on borders. In this type water loss by conveyance and deep percolation is heavy and the efficiency of irrigation is only 40-50 per cent at field level.

ii) Sprinkler method: Water is applied in the form of rain. Water is conveyed through pipes and sprayed through sprinklers. This method is most suited for steep slopy and sandy soils.

iii) Drip irrigation: Drip irrigation is adopted in water scarce areas for conserving water. In this method water is applied in drops around the root zone through a network of mains, sub-mains and lateral on line drippers. Studies at UAS, Bangalore indicated irrigations at 0.8 E Pan daily produced higher yields of quality babies.

Scheduling of Irrigation

Irrigating crop with required quantity of irrigation water at appropriate growth stages is of at most importance for increasing water use efficiency under irrigated conditions. Excess or deficit quantity of irrigation water at sensitive crop growth stage will affect their productivity considerably. So irrigation can be scheduled based on

* The soil moisture status.
* Meteorological approach.
* Phenological stage of crop plants.

Optimum depletion of soil moisture for scheduling irrigation is 50 per cent depletion of available soil moisture from the surface of soil on sandy loam to clay loam soils.

Irrigation scheduled at 0.8-1.01W/CPE could be followed for higher baby corn and fodder yields.

The results indicated the superiority of continuously non-stressed irrigations at IW/CPE ratio of 1.0 in terms of husked (66.02 q ha-1) and fodder yield (43.38 t ha-1). The next best treatments were IW/CPE ratio of 0.6 at 10-26 daysand 1.0 IW/CPE in the rest of the crop stages which recorded husked (60.44 q ha-1) and green fodder yield (38.67 t ha-1) as compared to delayed irrigation at IW/CPE ratio of 0.6 throughout (38.19 q ha-1 and 24.08 t ha-1 respectively)

Husked and green fodder yield of baby corn as influenced by irrigation level

Irrigation levels (DAS)			Husked yield	Fodder yield
10-25	26-40	41-harvest	(q ha-1)	(t ha-1)
	IW/CPE			
1.0	1.0	1.0	66.02	43.38
0.6	0.6	0.6	38.19	24.08
0.6	1.0	1.0	60.44	38.67
1.0	0.6	1.0	57.42	35.81
	CD at 5%		4.85	3.50

The sensory parameters indicated that scheduling of irrigation at I/CPE ratio of 1.0 throughout the crop growth recorded higher grade in terms of appearance (4.10), colour (4.00), texture (4.10), taste (3.50) and juiciness (3.60) followed by irrigation at IW/CPE ratio of 0.6 either at 10-26 DAS or at 26-40 DAS (3.90, 3.80,4.00, 3.70 and 3.60 respectively). While, irrigation scheduled at 0.6 IW/CPE throughout graded higher with respect to taste (4.60) and juiciness (4.10) but remained low with other parameters like apperance (3.40), colour (3.20) and texture (3.80).

Sensory parameters of baby corn as influenced by irrigation levels

Irrigation levels (DAS)							
10-25	26-40	41-harvest	Appearance	Colour	Texture	Taste	Juiciness
	IW/CPE						
1.0	1.0	1.0	4.10	4.00	4.10	3.50	3.60
0.6	0.6	0.6	3.40	3.20	3.80	4.60	4.10
0.6	1.0	1.0	3.90	3.80	4.00	3.70	3.60
1.0	0.6	1.0	3.90	3.70	3.90	3.90	3.70

The results of the nutritional parameter indicated that scheduling of irrigations at IW/CPE ratio of 1.0 throughout showed higher content of crude protein (18.90%), Calcium (0.51%), phosphorus (0.44%), potassium (2.74%) and crude fibre(5.41%) closely followed by delayed irrigations at IW/CPE ratio of 0.6 in the early stage. While continuous moisture stress at 0.6 registered higher sugars (0.025%) and ascorbic acid (106 mg 100g-1) compared to other treatments but, remained lowest with respect to other parameters like crude protein (12.65%), calcium (0.41%), phosphorus (0.28%), potassium (1.89%) and crude fibre (4.66%).

Reducing sugar, protein, calcium, phosphorus, potassium, crude fibre and ascorbic acid as influenced by irrigation levels in baby corn

Irrigation levels (DAS)			Sugars	Crude	Calcium	Phosphorous	Potassium	Fibre	Ascorbic acid
10-25	26-40	41-harvest	(%)	protein	(%)	(%)	(%)	(%)	(mg.100g-1)
	IW/CPE								
1.0	1.0	1.0	0.013	1890	0.51	0.44	274	541	17
0.6	0.6	0.6	0.025	1265	0.41	0.8	1.89	466	106
0.6	1.0	1.0	0.014	1830	0.50	0.40	263	535	74
1.0	0.6	1.0	0.016	17.47	0.50	0.38	251	5.17	79

Water requirement

Water requirement is defined at "the quantity of water regardless of its source required by a crop in a given period of time of its normal growth under field condition at a given place".

Baby corn is highly sensitive to water stress and water logging. Submergence of soil for 3-5 days during seedling to flowering stage reduces the yield considerably. Water requirement of the crop is 400-450 mm. Irrigation requirement varies with the type of soil and the season in which the crop is grown.

Effect of stress on growth, yield and quality of baby corn

Water deficit in plants to various degrees at different stages of growth leads to increase in leaf water potential and reduction in relative water content causing increase in canopy temperature. Leaf expansion and height of plant get reduced resulting in reduction in size of babies, eventually reduction in production potentiality of baby corn. Reduction of photosynthesis under water deficit is due to closer of stomata and this leads to reduced translocation of assimilates to different plant parts and ultimately to the sink. Stress at the later stage enhances reducing sugar in the baby corn and ascorbic acid content. It brings down the protein and other mineral contents.

There was 42 per cent reduction in yield due to delayed irrigations at 0.6 IW/CPE ratio throughout the crop growth for baby corn. The reduction was 44 per cent for fodder and total yield. This was closely followed by delayed irrigation at 0.6 IW/CPE consequitively from 26 DAS to harvest with 37 per cent reduction in yield of baby corn. The extent of reduction in yield was 25-30 per cent due to continuous stress from 10-40 DAS with irrigations at 0.6 IW/CPE ratio. Scheduling irrigations at 0.6 IW/CPE ratio from 41 DAS to harvest registered 19 per cent reduction in yield. Thus, it could be inferred that baby development (41 DAS-harvest) and baby initiation (26-41 DAS) stages are the most critical stages for irrigation in baby corn. During these stages adequate moisture through frequent irrigations needs to be maintained to realize higher yield and quality babies.

Water use efficiency

Efficient use of irrigation water has always been an important factor in irrigation system design and operation.

In irrigated conditions, efficient utilization of irrigation water and increasing productivity per unit of irrigation water depends on two factors. Firstly being efficient conveyance of irrigation water to the plot head and second being soil and plant characteristics. Water use efficiency is 17-19 kg hamm-1 for baby corn and 75-85 kg hamm-1 for green fodder. This could be further enhanced by adopting trickle irrigation with paired row planting.

Stress day index as influenced by irrigation schedules at different phenophases in baby corn

Irrigation schedule CPE (mm)			Yield (t ha-1)			Crop susceptibility (t ha-1			SD mm	SDI		
10-25	26-40	41-har	Baby corn	Fodder	Total	Baby corn	Fodder	Total		Baby corn	Fodder	Total
50	50	50	6.602	4.34	49.99	-	-	-	-	-	-	-
83.33	83.33	83.33	3.82	2.40	27.90	0.42	0.445	0.44	83.33	34.99	37.08	36.66
83.33	50	50	6.04	3.86	44.72	0.085	0.11	0.10	83.33	7.08	9.16	8.75
50	83.33	50	5.74	3.58	41.56	0.13	0.17	0.16	83.33	10.83	14.58	13.74
50	50	8.33	5.29	3.36	38.9	0.19	0.23	0.22	83.33	16.24	18.74	18.74
83.33	83.33	50	4.94	2.97	34.69	0.25	0.31	0.30	83.33	20.83	25.83	25.41
50	83.33	83.33	4.34	2.70	31.40	0.345	0.37	0.37	83.33	28.74	31.24	30.83

INTERCULTIVATION AND EARTHING UP

Intercultivation

Intercultivation operations in baby corn crop are carried out for manipulating the soil after the seed is planted or young plant has emerged. The objective is to control weeds and to have dust much in the soil surface. Large area can be easily weeded with the use of intercultural implements. Loosening the surface soil due to intercultivation enable to maintain high porosity and provides aeration in the root zone. Two Intercultivation with blade hoe at 15 and 30 days would be beneficial in maintaining physical condition and control of weeds.

Earthing up

This operation is done to provide anchorage to the crop to facilitate safe disposal of excess water during the rainy season. The most beneficial effect of earthing up in baby corn is reduced lodging which is expected to be more due to high plant density in baby corn fields. A ridge is formed in the cropped rows. Ridge plough can also be used for this purpose. Earthing up operation is usually followed at the time of last intercultivation.

WEED MANAGEMENT

The baby corn crop is found to be badly infested with numerous types of weeds in initial stages, which suppress the crop growth badly. Therefore weeding is done between the rows with bullock drawn implements. Where as the weeding with in the rows is done by hand. Two to three hand weedings at 15 days interval is necessary to keep the weeds under check. Effective weed control can also be obtained by spraying Simazine or Atrazine (@ 1-1.25 kg ha-1 of 50% WP) as pre-emergent application followed by hand weeding if required. Early control of weeds and maintaining weeds below the threshold level upto 30 days stage ensures higher yield of baby corn because the crop matures in 50-60 days.

DISEASES AND INSECT PESTS

Leaf blight caused by Helmithosporium tuicicum is the common prevalent disease. Selection of tolerant varieties would be the best option. In areas with high disease infestation spraying Dithane M-45 @ 0.20 to 0.25% as soon as the first symptom of disease is found to be effective in controlling the diseases. If need arises a second spray may be given after 15 days.

Among the insect pests shoot fly and stem borer are minor pests. However, they can be controlled by soil application thimet @ 25 kg ha-1

DETASSELING AND STAGE OF HARVEST

Detasseling is the process of removal of tassels in all the plants as and when they emerge, since the cobs have to be harvested for edible purpose before pollination. Tassel emergence in maize usually occurs between 45th-55th days depending upon the variety. The tassel will emerge at least a minimum of 5 days earlier to silk emergence. All the tassels in the plant rows must be removed before shedding of pollen. This operation is necessary for getting good quality babies. The tassels are removed by holding firmly with hand and giving an upward jerk. Though it is a labour consuming operation, it is still essential to avoid pollination and to get quality babies acceptable in the international markers. Detasseling helps in harvesting faster and gives better baby development. It also helps to increase the number of ears, quality and prevents seed growth. The labour for detasseling is estimated to be around 8-10 man days per hectare.

Stage of harvest

In baby corn since cobs are harvested for vegetable purpose, right time of harvest of babies will help in optimizing the yield and realizing the quality babies. Harvesting of baby corn is done by hands before pollination so that the deterioration of quality doesn't occur as a consequence of fertilization. Care should be taken so that stem and leaves do not break to avoid damage to other emerging baby corn ears. Systematic work under ICAR ad-hoc project at Bangalore revealed that delay in harvesting of babies resulted in increased yield of husked and dehusked babies, but from quality point of view and also the preference of the consumer harvesting babies within three days after silk emergence would reslt in 97 to 102 q ha-1 of husked baby yield and 25 to 29 t ha-1 green fodder yield.

Husked, dehusked, fodder yield and sensory parameters as influenced by stage of harvest in baby corn.

Stage of harvest	Husked yield by ha-1)	Dehusked yield (q ha-1)	Fodder yield (t ha-1)	Appearance	Colour	Texture	Taste	Juiciness
Soon after cob emergence	84.33	19.74	28.07	4.21	3.86	4.02	3.18	3.30
Soon after silk emergence	92.82	21.19	29.10	4.06	4.04	3.81	3.75	3.71
3 days after silk emergence	99.96	23.82	27.25	3.65	3.58	3.44	2.91	2.91
5 days after silk emergence	110.10	27.74	29.34	3.12	3.14	3.06	2.41	2.64

Sensory parameters showed highest score for appearance, colour, texture, taste and juiciness when harvested soon after cob emergence followed by after silk emergence. While, nutritional parameters viz. protein, phosphorus and calcium declined progressively with delay in harvest from soon after cob emergence to 5 dyas after silk emergence. On the contrary sugar and fibre progressively increased with delay in harvest. Hence it could be possible to strike a balance between optimum yield and quality babies by harvesting within three days after silk emergence are more aceptable or palatable.

Sugar, protein, phosphorus, potassium, calcium and fibre content as influenced by stage of harvest in baby corn.

Stage of harvest	Sugar (%)	Protein (%)	Phosphorus (%)	Potassium (%)	Calcium (%)	Fibre(%)
Soon after cob emergence	0.0173	17.31	0.864	2.91	0.39	3.18
Soon after silk emergence	0.0182	14.97	0.854	3.05	0.30	4.32
3 days after silk emergence	0.0217	13.61	0.743	2.87	0.36	4.98
5 days after silk emergence	0.0259	11.78	0.651	3.02	0.24	5.79

Generally 2-3 pickings should be done at an interval of 2-3 days. Harvesting of baby corn earlier than this stage may reduce the yield and the reduced ear size may pose problem in marketing. owever, harvesting can also be followed every day which lasts for 8-10 harvests to avoid over maturity of baby corn because the right stage for harvest is the critical criterion for better value in the market.

PROCESSING AND MARKETING

The processed ear should be bright yellow and have a mild corn taste, a crunchy texture and uniform length and shape. Crop, which is intended for retail fresh markets, need not have ears that are long and slender. Standards in Taiwan specify ears measuring 10 cm long and 1-2 cm in diameter. The optimum size requirements for the market/cannery industry is 4.5 to 10 cm long and 7 to 17 mm diameter of young dehusked baby corn. Baby corn can be canned in a solution of 3% salt, sugars (2%), acetic acid (1.4%) or vinegar and citric acid (0.3%).

Fresh baby corn with the husk should be purchased from the market to maintain crispness and flavour. To retain sweetness, it should be refrigerated immediately. Husked baby corn can be refrigerated for up to one week without loosing its quality. If kept at ambient temperature, the husked babies can stay for 2-3 days only. It should be kept in polyethylene bags with vents in a well-ventilated place. Baby corn stays for months in freezers. Depending upon the size, one kilogram of baby corn contains 20 to 30 cobs. The yield of dehusked cob varies from 400 to 450 gms per kilogram of husked baby corn. A 200 gm pack of freshly harvested baby corn is being sold for Rs. 40-50 in the vegetable stalls of Delhi posh colonies. In Bangalore husked baby corn is being sold in HOPCOMS at Rs. 12-15 a kilogram and dehusked corn in attractive tin foil with 200 g is priced at Rs. 25-30. In Himachal Pradesh, the fruit processing unit of Himachal Pradesh Fruit Processing and Marketing Corporation (HPMC) at Jarol near Sunder Nagar in Mandi District is packing 230g baby corn ears in a tin having 425g net weight and marketing the canned product in Mumbai market. In Bangalore Sterling Agro, Banneraghatta Road, IQE, Indiranagar and Namdhari eeds are the potential buyers of baby corn for processing and exporting. In addition there are many contract farms which work on buy back system.

Since 1987, Thailand produced approximately 77,750 tons of baby corn annually of which almost 33% is canned, exported earning 18 million US$ annually. In India this industry is still in the developing stage.

Marketing of Baby Corn

Decision regarding the marketing is the prime consideration in the production of baby corn. When the crop is new to the farmer/region, before planting baby corn on a large scale, planting a small plot to familiarize with the operations like detasseling, harvesting, storage, and marketing techniques is essential. Detasseling stimulates fast baby corn development and improved weight. If the silks are pollinated, the quality of baby corn declines fetching normally less price. usked baby corn should be sold to maintain moisture and ear quality. If the husks are removed, that leads to damaged, discolored, and desiccated babies.

damaged, discolored, and desiccated babies. Direct marketing to restaurants and at farmers market by the local growers have the advantage of providing a fresh, tsty product for consumers who have not had the pleasure of experiencing fresh baby corn.

Harvesting of baby corn at optimum maturity stage (soon after silk emergence) can ensure the quality criteria viz., uniform maturity, color, shape, size, and kernel coverage and be free from defects. Although, each plant can bear 2-3 babies, first formed baby is very good to good, while the second is good to fair and the third is poor to very poor in quality. Careful handling to prevent mechanical damage while harvesting and transportation, controlling temperature and moisture unitl the product reaches the market can extend the shelf life to as high as 7-10 days. Inadequate or slow cooling, poor temperature maintenance or inappropriate packaging can rapidly lead to post harvest problems and quality loss in baby corn.

Harvesting should be carried out in the morning, when the cob moisture content is higher and ambient temperatures are lower. This also saves the energy costs and time needed for precooling. Harvesting should be conducted on every alternate days and normally lasting 8 to 14 days. Ears are harvested using a knife or secateurs and should not be snapped or broken to avoid mechanical damage. harvested ears should be kept in shade and precooling must be carried at the earliest to avoid heating up. Cooling process can be started with the application of a constant flow of clean water. Water must be distributed evenly over the load of corn at a rate of 2 liters per kilogram of corn per hour. For every hour delay in cooling after harvest, baby corn loses shelf life by 10-12 hours.

Precooling

The best method of precooling baby corn is hydrocooling, where in baby corn (husked and dehusked) is drenched or immersed in near-freezing water for 20 to 30 minutes to remove field and respiratory heat and other heat emitted while transportation or storage can also be removed by top ice cooling. Here 1 kg ice is used for every 5 kg of baby corn. With these cooling methods, the baby corn is protected from water loss and in some cases may even absorb water. Crushed ice is normally used in small-volume operations. Several types of hydrocooling methods are suitable for baby corn, including the conveyor-shower system, the batch-shower system, and the conveyor-immersion system.

In conveyor-shower hydrocooling process, baby corn is passed along a conveyor and under a shower of chilled water. The conveyor moves I foot per minute. Uniform stacking of the baby corn was necessary to prevent water channeling and nonuniform cooling.

In batch shower system, the product remaining stationary. Cold water is poured over the top of the pallet load, collected at the bottom, recooled, and recycled. Here care must be ensured to see the uniform water movement and cooling.

In conveyor-immersion system, hydrocoolers are normally large boxes of chilled moving water. Crates of corn are loaded onto the conveyor at its entrance, submerged, moved through the chilled water, and removed at the other end. This system is most efficient than others, because the cold water comes in contact with the entire product and ensures uniform cooling.

When hydro cooling operations are used, post harvest diseases may develop, particularly in products that have sustained mechanical damage. With recirculating systems, disease may spread to entire product. This can be reduced by using chlorine as a disinfectant in the water at the rate of 100 to 150 ppm in the form of sodium hypochlorite or dry as calcium hypochlorite.

Grading and Packaging

Baby corn is graded by size. The size requirements vary according to the market. Generally 6 to 8 cm, 8-10 cm and 10-12 cm long grades are used. In the outlets of food world, 200 g dehusked baby corn wrapped in polystyrene bags is being sold at Rs. 25/- while, 500 g fresh husked baby corn costs Rs. 12/-.

Packing is normally carried out after cooling. Dehusked baby corn is placed in perforated plastic clamshells or punners for retail markets. Polystyrene or plastic trays wrapped with film can also be used.

Packaging for export consists of either one-or two-piece self-locking telescopic cartons with ventilation in all four side walls. Carton dimensions vary depending on net weight and market. The most common packs weigh 2 to 2.5 kilograms of 40 cm long by 30 cm wide and 9 cm height ISO pallets. Packages should bear all the labeling information required by the importing countries like country of origin. Product/variety, Net weight and Exporter name/importer name.

Processed baby corn often packed in metal cans and glass jars. Baby corn preserved in brine and packed in glass jars is more expensive than canned baby corn, and consequently has higher quality. Baby corn in glass jars is a speciality item found mostly in gourmer supermarkets. Restaurants and other food industries usually do not purchase baby corn in glass jars because it entails difficulty in storing, is prone to damage, and more costly than canned baby corn.

Storage

Baby corn should be stored at 5oC to 7oC, with a relative humidity of 90 per cent. The respiration rate increases 8 to 10 times at 28oC than 0oC. Low temperatures reduce the rate of the conversion of sugar to starch. As much as 80 per cent of the sugar lost within 24 hours of harvest in ears stored at 30oC.

Transportation

Because baby corn is highly perishable, exports are made by air. Packages should be transported from the packing facility to the airport in cool trucks, especially if the corn has been cooled. In all cases, trucks should be covered to prevent contact with wind, rain, and sun.

Air shipments are made in aircraft containers or pallets. Heat can build up in the containers, especially if they are left exposed to the sun while awaiting loading in the airport. This is obviously detrimental to the corn. Attempts should be made to ensure that the aircraft containers are held in shady or cool locations until loading.

NUTRITIVE VALUE OF BABY CORN FODDER

Baby corn is harvested at about 65-70 days depending on the variety and as a dual purpose crop also provides soft, succulent, green, palatable and nutritious fodder suited for direct feeding or could also be ensiled for off-season feeding. It consists of

Protein	:	**9-10%**
Neutral detergent fibre (NDF)	:	**67.21%**
Acid detergent fibre (ADF)	:	**50.51%**
Lignin	:	**8.86%**
Lignin/ADF	:	**0.175**

On the contrary, the popularly grown exclusive fodder maize variety South African Tall has

Protein	:	**10-11%**
Neutral detergent fibre (NDF)	:	**68.96%**
Acid detergent fibre (ADF)	:	**43.40%**
Lignin	:	**9.68%**
Lignin/ADF	:	**0.223**

In animal nutrition, digestibility of fodder is an important parameter apart from absolute nutrient content in the fodder. Lignin/ADF ratio is an index of digestibility is lower in baby corn compared to South African Tall indicating higher digestibility of baby corn fodder. Thus, in places where exclusive fodder maize is grown, baby corn can be a profitable substitute with 35-40 t ha-1 of green fodder.

COST ECONOMICS

Cost of Baby Corn Production and Returns

Cost of baby corn production and economic returns

Sl.No	Particulars of operation	Item/quantity	Rate(Rs.)	Total Amount (Rs.)
01.	Pre-ploughing irrigation	Daily wage labours (6)	45/day	270.00
02.	Land preparation (2 ploughing + passing cultivator and leveling)	Bullock pair (5)	200/day	1000.00
		Men labours (8)	45/day	360.00
03.	Seed	40 kg	125/kg	5000.00
04.	Sowing	Bullock pair (3)	200/day	600.00
		Women labour (10)	42/day	420.00
05.	Manures and fertilizers	FYM 10 tons	200/ton	2000.00
		Urea 326 kg	5.00/kg	1630.00
		SSP 469 kg	3.20/kg	1501.00
		MOP 67 kg	4.60/kg	308.00
		Men labour (6)	45/day	270.00
06.	Irrigation	Men labour (12)	45/day	540.00
07.	Weeding (twice)	Women labour (20)	42/day	840.00
08.	Hoeing (twice)	Bullock pairs (2)	200/day	400.00
09.	Detasseling	Women labour (20)	42/day	840.00
10.	Harvesting (8-10 picking)	Women labour (100)	42/day	4200.00
11.	Harvesting of green fodder	Men labour (15)	45/day	675.00
		TOTAL		20854.00

Out put and returns

	Husked baby yield (q ha-1)	Green fodder yield (t ha-1)	Gross return (Rs.)	Net return (Rs.)
Golden baby	94.23	17.55	84159	63305
PAC-792	88.62	29.90	85846	64992
PAC-793	104.58	47.36	107344	86490

Baby corn hybrids on an average can yield 85-105 q ha-1 of husked baby and 15 to 45 t ha-1 of green fodder. Despite high cost on seeds, detasseling and picking the average cost of cultivation is Rs. 20,000 to 21,000 ha-1 and the net returns could be Rs. 60,000 to 85,000 ha-1 from a single crop of baby corn and on an average 3 to 4 crops can be raised in a year depending upon the climatic conditions and availability of irrigation water.

We hope **Detailed Feasibility Report** in your possession at the time, must have conveyed you the elementary idea on process data, market and economics. We feel you must have now taken a decision to finalize your project plan for ultimate implementation in a successful manner. Before you go ahead, we suggest you to take our ***MARKET SURVEY CUM DETAILED TECHNO ECONOMIC FEASIBILITY REPORT.***

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- Introduction
- Properties
- BIS (Bureau of Indian Standard) Specifications & Requirements
- Uses & Applications
- Present Indian Market Position
- Expected Future Demand
- Export & Import Statistics Data
- Names and Addresses of Existing Units (Present Manufactures)
- List of Plant & Machineries
- Miscellaneous Items and Accessories
- Instruments, Laboratory Equipments and Accessories
- Electrification, Electric Load and Water
- Maintenance, Suppliers/Manufacturers of Plant and Machineries
- Process of Manufacture with formulae if applicable
- Flow Sheet Diagram
- List of Raw Materials
- Availability of Raw Materials
- Requirement of Staff & Labour
- Personnel Management
- Skilled & Unskilled Labour
- Requirement of Land Area
- Built up Area
- Plant Layout.

along with financial details as under:

Summary of Capital Cost of Project
Land & Side Development Exp.
Buildings
Plant & Machineries
Misc. Fixed Assets
Technical Know how Fees & Exp.
Preliminary Expenses
Pre-operative Expenses
Provision for Contingencies

below mentioned financial statements (Annexure) will be for 5 to 10 Years

Annexure :: Cost of Project and Means of Finance
Annexure :: Output, Profitability and Cash Flow Chart
Annexure :: Assessment of Working Capital requirements

Annexure :: Sources of Finance
Annexure :: Balance Sheets
Annexure :: Break-Even Analysis and profitability analysis.
Annexure :: Quantitative Details-Output/Sales/Stocks
Annexure :: Sales Realisation
Annexure :: Raw Material Cost
Annexure :: Other Raw Material Cost
Annexure :: Packing Material Cost
Annexure :: Consumables, Store etc.,
Annexure :: Employees Expenses
Annexure :: Fuel Expenses
Annexure :: Power/Electricity Expenses
Annexure :: Repairs & Maintenance Exp.
Annexure :: Other Mfg. Expenses
Annexure :: Administration Expenses
Annexure :: Selling Expenses
Annexure :: Depreciation Charges - Profitability
Annexure :: Depreciation Charges
Annexure :: Interest and Repayment - Term Loans
Annexure :: Tax on Profit
Annexure :: Assumptions for Profitability workings
Annexure :: Assessment of Working Capital

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