

## Reishi mushroom (*Ganoderma lucidum*)

*Ganoderma lucidum* and related species have the longest historical usage for medicinal properties dating back at least four thousand years. In Japan it is called Reishi and in China and Korea it is variously called Ling Chu and Ling Zhi (Mushroom of immortality). Traditionally it has been used widely in the treatment of hepatopathy, chronic hepatitis, nephritis, hypertension, arthritis, insomnia, bronchitis, asthma and gastric ulcer. Scientific studies have confirmed that the substances extracted from the mushrooms can reduce blood pressure, blood cholesterol and blood sugar level as well as inhibit platelet aggregation. *Ganoderma* species are famous tonic in Chinese medicines. They are widely distributed in India on tree trunks. For 4000 years *G. lucidum* has been used as a part of Chinese and Japanese medicine especially for the treatment of most of the human ailments including chronic hepatitis, nephritis, hepatopathy, neurasthenia, arthritis, bronchitis, asthma, gastric ulcer, etc. Extracts from fruiting bodies and mycelia of *G. lucidum* occurring in South India were found to possess *in vitro* antioxidant activity

Reishi (*Ganoderma lucidum*) is pharmacologically as well as commercially the most important medicinal mushroom in the world with current global trade of about 2 billion dollars; trade in India has crossed Rs.100 crores annually through imports from Malaysia and China. Directorate of Mushroom Research has developed cultivation technology of Reishi, which is described here

### Cultivation

Reishi can be grown seasonally in the low cost growing rooms preferably in poly houses and also in the environmentally controlled cropping rooms. As the mushroom is intended to be used exclusively as medicine, it has to be grown organically; seasonal farmers have to put up polythene cover on the top and sides of the thatched huts and utmost hygienic conditions have to be maintained to prevent diseases and pests as no toxic chemical is to be used.

Reishi is grown on the sawdust of the broad-leaved trees (mango, poplar, coconut, sheesham). Sawdust, obtained from saw mill, is amended with 20% wheat bran and is wetted to a level of 65% moisture. 1% of Calcium sulphate (gypsum) and 1% of calcium carbonate (Chalk powder) are added per kg sawdust to get a pH of 5.5. The mixed substrate (700 g dry wt; 2.1 kg wet) is filled in polypropylene bags the mouth of which is then plugged with cotton after putting a plastic ring like wheat grain spawn pack of mushrooms in polythene bags.

The bags are then sterilized in autoclave at 22 psi for 2 hours. After cooling, the substrate is spawned with wheat grain or saw dust spawn @ 3% on the dry weight basis, as it is comparatively a slow growing fungus. Spawn-run (incubation) is done at 28-35°C in the closed rooms (high carbon dioxide) and darkness. After the complete spawn run (bags white all over), which takes about 25 days, polythene top is cut at the level of the substrate totally exposing the topside and proper conditions for fruiting or pinning (temp. 28°C, 1500 ppm CO<sub>2</sub>, 800 lux light, 95% RH) are provided.

Once the pins have grown up enough to form the cap which is indicated by the flattening of the whitish top of the pinhead, humidity is reduced to 80% RH and more fresh air is introduced to achieve around 1000 ppm CO<sub>2</sub>. Once the cap is fully formed, which is indicated by yellowing of the cap margin (that is otherwise white), temperature is lowered to 25°C and RH is further reduced to 60% for cap thickening, reddening and maturation of the fruit-bodies.

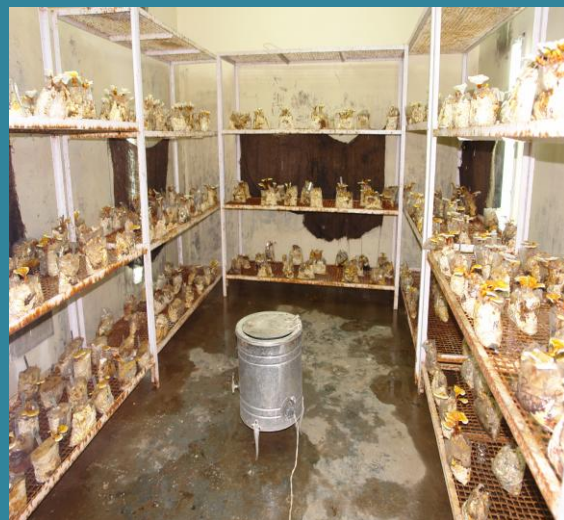


Developing fruit bodies of *Ganoderma*

Full maturity is indicated, when the cap is fully reddish brown and spores are shed on the top of the cap. Harvesting is done by the tight plucking, holding the root with one hand and pulling up with another; scissors and knives can also be used but no residual bud is left after harvesting. One cycle of the growing takes 10-15 days. After harvesting the first flush, conditions for pinning are again switched on (i.e. 28°C, 95% RH, 1500 ppm CO<sub>2</sub>, 800 lux light) for starting and completing the second flush. Depending upon the conditions, 2-3 flushes appear and a total 25% B.E. can be achieved (250 g fresh mushroom from one kg dry substrate). One crop cycle takes about four months.

Some workers consider *Ganoderma* a mild pathogen and many countries like Australia, New Zealand do not allow its direct entry. Hence it is important that due care is taken during cultivation to check that the spores do not get distributed freely and the substrate after cultivation is properly cooked out to prevent accumulation of inoculum in the fields or forest areas, or dried and burnt as fuel.

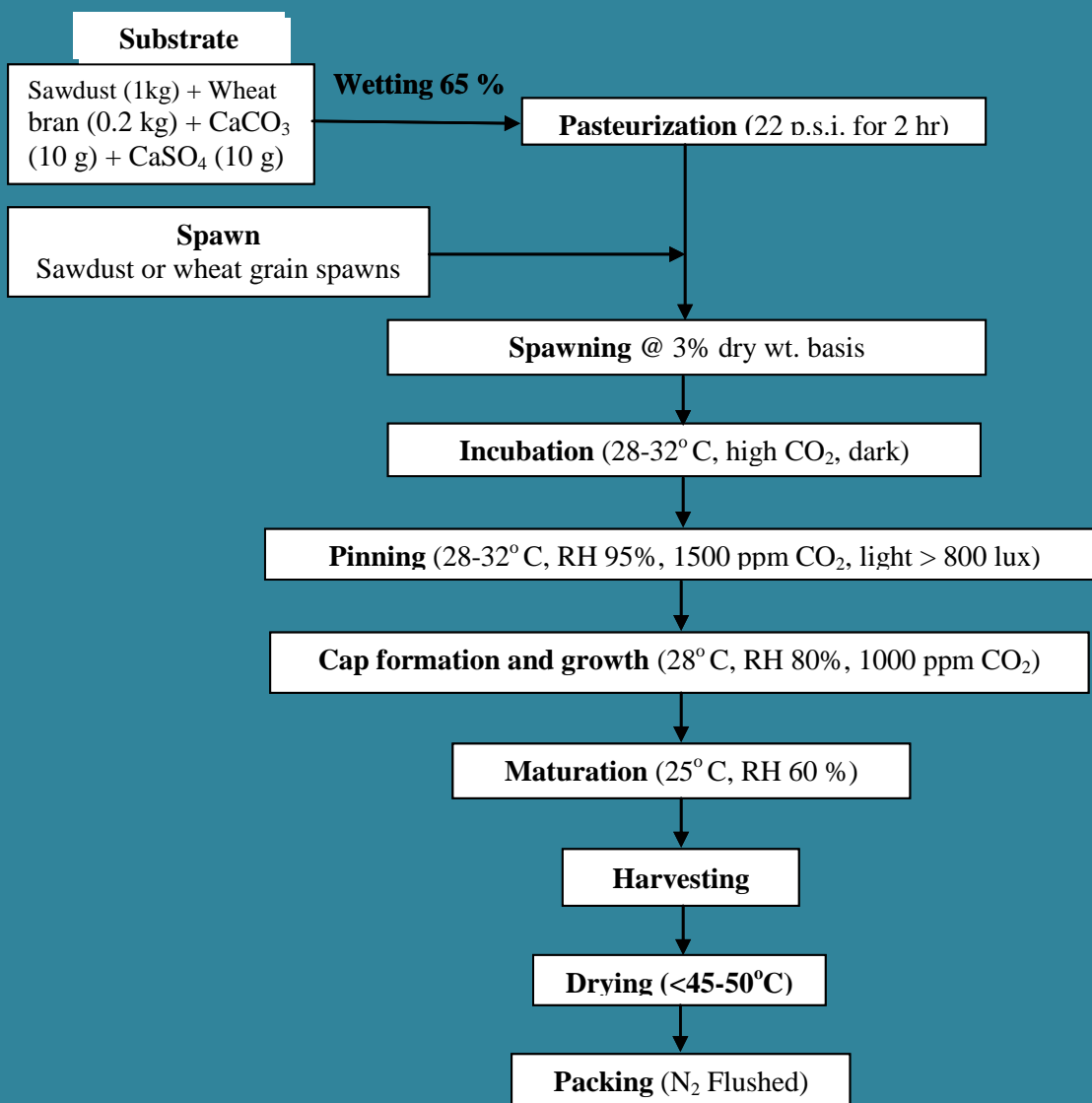
Harvested mushrooms, after washing with water, are dried at low temperature (<50°C) in the cabinet driers, preferably at 35°C in the dehumidifying cabinet drier. Freeze drying is, however, the best. *Reishi* mushroom has very high dry matter (45% i.e. 450 g dry from 1 kg fresh). Fig.3 shows the flow chart of *Ganoderma* cultivation.



*Ganoderma* cropping stage

## Marketing

Reishi is used as medicine and not as food because it is bitter and corky hard. Any one growing it has to find the market, which is basically herbal medicine and food supplement (nutraceuticals) sector. Manufacturers of herbal medicines and food supplements can process, pack and trade it in various forms-capsules, tablets, liquid extracts or even *Reishi*



Flow diagram of *Ganoderma* cultivation

## Economics of ten ton production per annum

Capacity = 10 ton fresh/annum

Cost = Rs.2861000/

Net Profit per annum = Rs.3537500/

### Growing facility required

Production facility (5 Cropping rooms) = 5 (10'x40'x10')

No of bags to be accommodated = 8000 (2kg each)

Cycle to be completed in a year = Four

Expected yield from four cycles (Fresh) = 10000 Kg/ annum

= 4500 Kg /annum (dry)

### Cost

#### 1. Non Recurring

##### A. Machinery/equipments

Machinery/equipments	Quantity	Rate	Amount
Autoclave	One	800000.00	<b>800000.00</b>
Laminar flow	One	200000.00	<b>200000.00</b>
		<b>Total</b>	<b>1000000.00</b>

##### B. Cropping Rooms

Material/item	Quantity	Rate (Rs)	Amount (Rs)
<b>Cropping rooms</b>	Five (10'x40'x10')	800/sq ft.	<b>1600000/-</b>
<b>Autoclave room</b>	One (10'x10'x10')	500/sq ft	<b>50000.00</b>
<b>Mixing room</b>	One (10'x10'x10')	500/sq ft	<b>50000.00</b>
<b>Store</b>	One (10'x10'x10')	500/sq ft	<b>50000.00</b>
		<b>Total</b>	<b>1750000.00</b>

## 2. Recurring Cost

Expenses to incur on raw materials and energy

Material/item	Quantity	Rate(Rs)	Amount (Rs)
Saw dust	270q	150	40500.00
Wheat bran	27q	1000	27000.00
CaSO <sub>4</sub>	3.5q	5000	17500.00
CaCO <sub>3</sub>	3.5q	5000	17500.00
Rings	9000	1.0	9000.00
Spawn	20q	5000/q	100000.00
Non Absorbent cotton	3.5q	5000	17500.00
Electricity charges	12months	4000	48000.00
Miscellaneous	12months	2000	24000.00
		<b>Total</b>	<b>301000/-</b>

## 3. Wages

Labour (3 Person)	12months	4000	144000.00
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## Cost of Production

### Interest and depreciation

On building	Cost ( Lakh)	Interest and depreciation ( Rs)
5% depreciation 12% Interest	1750000/-	297500/
<b>On machinery</b>		
10% depreciation <b>12% interest</b>	1000000/-	220000/-
<b>Total</b>		<b>517500.00</b>

### Cost of production and return

	Rs
1. Raw materials	: 301000
2. Wages and salary	: 144000.00
3. Interest and depreciation	: 517500.00
<b>Total</b>	<b>: 962500/-</b>

## Cost and Benefit

Cost of production = 962500/-

Selling price @ Rs 1000/ Kg ( Rs1000 X 4500 Kg) = 45,00,000/-

**Net return per year = 3537500/-**