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“Effect of Solar Heating System on Performance of Kadaknath Poultry Farming”

¹ Umanand Kumar; ²Dr.Manoj Kumar Gupta; ³Dr.Subhash Chandra Solanki

¹Ph.D. Scholar; ^{2,3} Professor

^{1,2,3}Mechanical Engineering Department, Ujjain Engineering College, Ujjain,
Madhya Pradesh, India

⁴Kushal Sharma, Assistant Professor Mechanical Engineering Department, Dr.APJ
Abdul Kalam University Institute of Technology, Jhabua, Madhya Pradesh, India

Abstract: In the Kadaknath poultry farming house, fuel/electric-based heating systems are generally used to maintain the required temperatures for high production rate of chicken breeding. A huge amount of fuel/Electricity consumptions for this farming, which leads to high operational cost and creates lots of air pollutant emission to atmosphere. In the recent energy scenario of energy crisis and conventional energy shifted to use renewable energy. In this studies the application of a solar heating system (SHS) for the Kadaknath poultry farming.

Keyword: Solar energy, Solar Air Heater, Hybrid System, Incubator, Brooder, Poultry Farming, etc.

1. Introduction:

Solar energy is the most easily and abundantly available. Poultry industry is one of the important industries which require huge amount of energy to maintain suitable indoor atmospheric conditions for chicks. Kadaknath (Kali Massi) is a special breed of chicken which is originated from Jhabua (M.P.). Presently, Kadaknath farming uses conventional heating (Electrically) mostly during incubation of egg and brooding of chicks continuously. A considerable amount of electricity consumed leads to high production cost as well as maintenance cost but world poultry industries are still dominated by traditional energy. It has been found that up to 85% energy saving can be achieved by using renewable-based advanced technologies in poultry houses as compared to the traditional with a payback time of 3–8 years.[1] Light is an important environmental factor for the poultry industries. The birds kept under artificial light-based heating showed higher drowsy behavior, while natural daylight heating showed higher frequencies of eating, drinking, and preening behaviors resulting in heavier final body weights while the other production parameters remained unaffected. Moreover, birds kept under natural light showed significantly better gait score and lower incidence of tibial dyschondroplasia.

Furthermore, natural light was found to significantly decrease the levels of serum corticosterone indicating lower stress levels.[2]

Green light of 50 Lux has desirable effects on the performance traits. The lowest concentration of haemoglobin and haematocrit is observed in red light.[7]

2. Literature Survey:

In this synopsis, different researches related to the topic of the present research work. That includes several researches that have tackled of heating poultry houses as energy aspect.

The research, Heidi El Zanaty (2015) developed a heating system for poultry farming using of renewable energy which mainly found that its overall cost is very lesser than traditional heating system (fuel based) and no bad impact on environment.

Tugba Gurler et.al (2018); designed a HVAC system, using solar heat pump(PVt based) for energy-efficient poultry houses during winter and summer season which results reduce the carbon footprint and cost of poultry house.

Nur Irsalina Ah Khaliludin et.al (2020); Case studied at PPNJ poultry, solar thermal system to reduce consumption of fossil fuel which reveals that about 88 % of the total energy input for scalding process has been contributed by solar thermal with about 2 % energy loss.

Haytham M. Dbouk et.al (2020); Using solar water heater to maintained the temperature of brooder (growing phase of chicks), resulted that required temperature the chicks during the winter period, which was cutting down the costs of fuel and electricity used for warming and save about 60% of heating costs.

The research, Shahabodin Gharahveysi et.al (2019) studied about the effects of colour and intensity of artificial light produced by incandescent bulbs on the performance traits, thyroid hormones, and blood metabolites of broiler chickens and found that the effect of green light (50 lux) on the performance traits was better.

S.Ezhil Valavan et.al (2016); Studied about external and internal egg qualities & chicks growth, found that hatch weight of Kadaknath egg ($28.55 \pm 0.12\text{g}$), one day old Kadaknath chick ($26.03 \pm 0.53\text{ g}$) & eight week chicks weight of male & female $483.13 \pm 1.31\text{ g}$ & $420.52 \pm 1.17\text{ g}$.

Mayur Gopinath Thalkar (2019); Studied about Kadaknath production, mortality rate, commercial scale, growth, medicinal value, etc. & found that mortality rate of Kadaknath were about 50% but now still about 12% with using of new technology & have high nutrients value like proteins (25%) highest ever any kinds of chicken.

The research, E.O. Uzodinma et.al (2020) developed a hybrid solar powered poultry egg incubator & analyse that the average percentage hatchability and incubation temperature after three observation were 62.3% and 37.6 °C respectively & its relative humidity recorded was within the required range of 50%–75%.

Okolie Paul Chukwulozie et.al (2012); Designed a temperature-controlled solar heated chick Brooder that makes uses of solar as source of the required heat in the housing for growth of chicks about six month and its air flow rate for 100 chicks was found to be 0.0236m³/s & the optimum air velocity(0.4m/s) & air flow 0.85m³/hr-bird.

3. Proposed work:

Currently, the Kadaknath poultry industry at Jhabua (M.P.) is based on a purely conventional type of farming. It uses huge electricity to create desired environmental conditions.

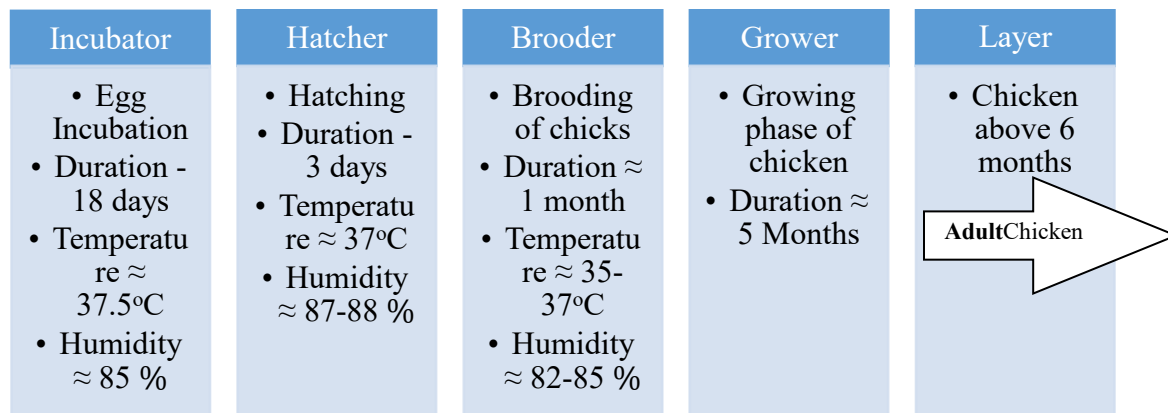


Figure 1: Procedure of Kadaknath Production

In place of electrical heating & conditioning process, a new hybrid system i.e., Integrated Solar Air Heater is being proposed in this project & following parameters will be analysed:

1. Hatchability = $\frac{\text{No. of chicks}}{\text{Total no. of fertile egg}}$
2. Productivity = $\frac{\text{No. of adult chicken}}{\text{No. of chicks}}$
3. Total productivity = $\frac{\text{No. of adult chicken}}{\text{No. of fertile egg}}$
4. Energy Analysis
5. Cost Analysis
6. Other parametric Analysis.

3.1 Kadaknath farming Performance:The reproductive and productive performance traits includes broodiness, hatchability percent on total eggs basis, age at first egg and egg production during first, second, third and fourth laying cycles. Under natural setup, after the attainment of sexual maturity, a hen starts laying eggs which continues for a period of 15 to 20 days. This period may be termed as a "laying period", after this the bird becomes broody and incubates the eggs for 21 to 26 days. This period may be termed as "incubation period". After the hatching of chicks hen broods them for 35 to 70 days, this period may be termed as "brooding period". This completes one laying cycle and then the birds enter next laying cycle. Each laying cycle comprise of 3 to 4 months duration, which results in 3 or 4 laying cycles per year. Although the birds lay eggs throughout the year but the frequency is extremely low during summer, particularly in the month of May and June. Even if eggs are laid, the hatchability was very poor.[12]

3.2 Chicks Growth parameter:

S.No.	Time	Space required per chick	Temperature	Velocity
1.	First week	100-120 cm ²	35°C	0.2 m/s
2.	2-4 weeks	250-300 cm ²	35/29.5/27°C	0.3/0.3/0.4 m/s
3.	5-8 weeks	700-800 cm ²	27°C	0.4 m/s

3.3 Proposed Step to implementation of work:

Step I Experimental set-up

Step II Observation

Productivity of Chicks

Energy Analysis

Performance Analysis

Step III Results & Discussion

3.4 Existing Incubator:It is an insulated device which used to control the temperature, humidity, and other environmental conditions as required for growth, hatching, or reproduction.

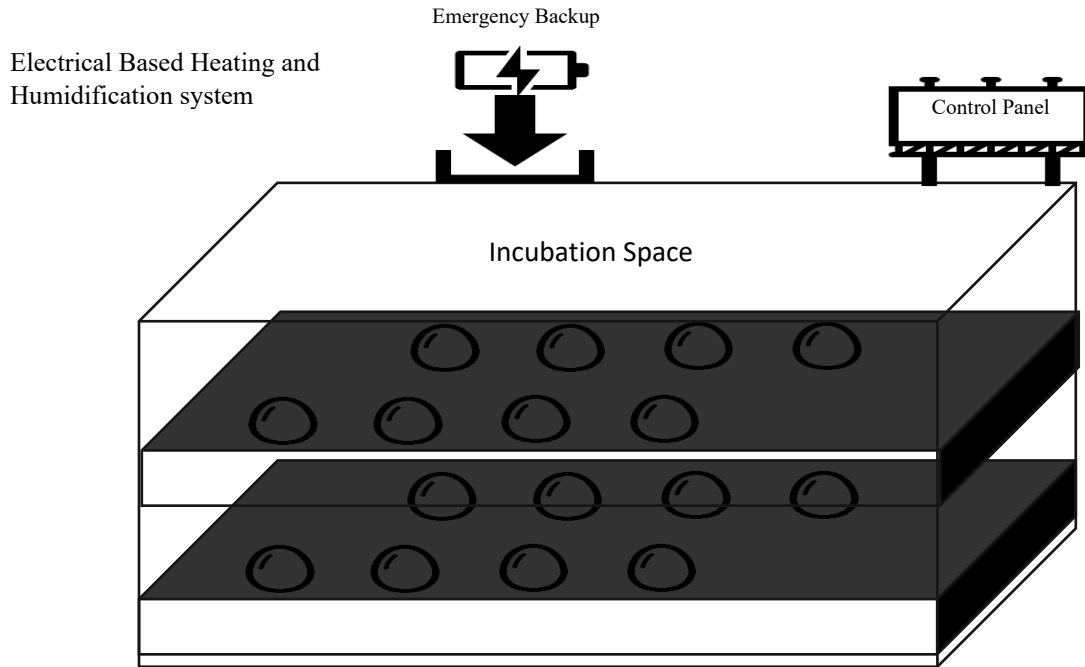
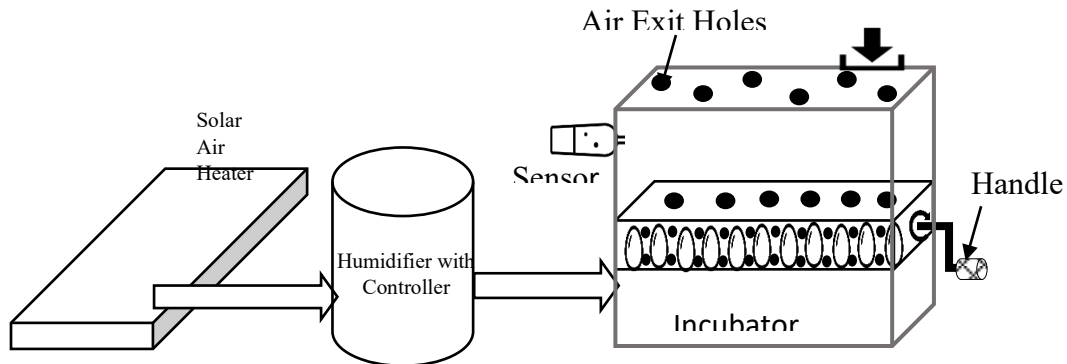


Figure 2: Existing schematic diagram of Incubator

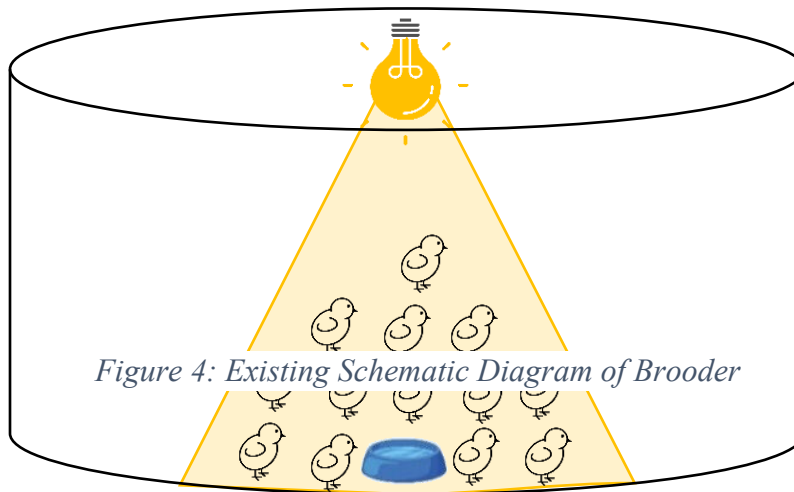
3.5 Proposed Schematic Diagram of Incubator: Krishi Vigyan Kendra (KVK) Jhabua is also motivating farmers for using solar poultry Incubator/ Hatchery, with the aim to conserving resources. As a result, a total of 40 Kadaknath growers are using solar poultry incubator for hatching the eggs.



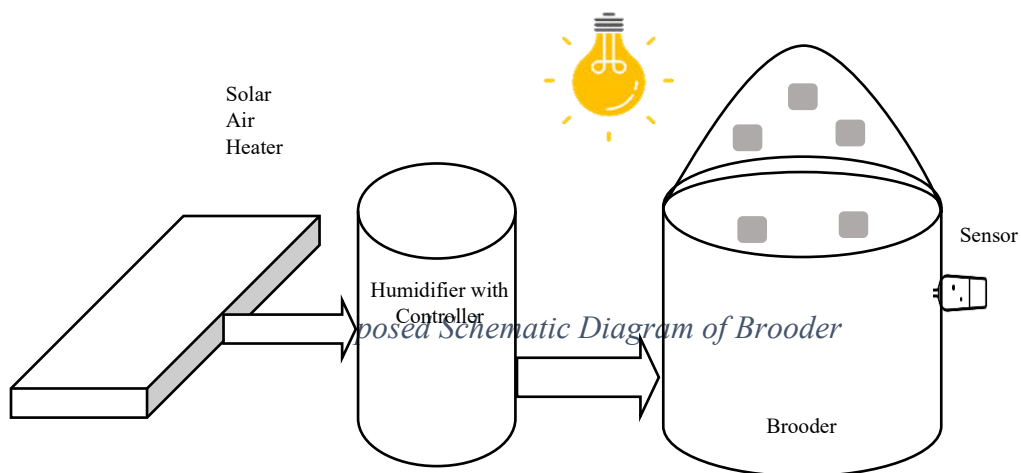
Backup

3.6 Existing Brooder: It is a space where we control the environmental conditions as required for the growth of chicks.

Figure 3: Proposed Schematic diagram of Incubator



3.7 Proposed Schematic Diagram of Brooder



4. Benefits of hybrid system:

Electricity is the one of the most important element for a poultry farm. Due to high electricity consumption, the operation cost is also high. With the help of this system to run the fans and tunnel ventilation, and other system in the farming houses during hot seasons, huge amount of chickens can die in few minutes. Dependency on fossil fuels is reduced and finally, the carbon footprint is reduced.

5. Outcome:

This research will give the “Integrated Solar Air Heating system (i.e. hybrid system) which will be reduce the operational cost and increase the total productivity of Kadaknath farming

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