

Goat-based integrated farming

Circular economy model for doubling farmers' income

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The ICAR-Central Institute for Research on Goats (CIRG) has developed an innovative goat-based Integrated Farming System (IFS) model tailored to marginal farmers with small landholdings (0.4 hectares). This model integrates goat farming (20 goats), poultry rearing (250 birds), vermicomposting, azolla cultivation, and fodder production to maximize resource utilization and profitability. Over 30 months, the system demonstrated significant economic and ecological benefits, with annual net returns of ₹3,87,766 compared to ₹2,38,263 from goat farming alone and ₹72,071 from poultry farming. Additionally, the IFS model supports sustainability by reducing waste, enhancing soil fertility through legume intercropping, and utilizing farm by-products. It generates 312 man-days of employment annually and is particularly suitable for semi-arid and arid regions, where traditional farming faces challenges due to erratic rainfall. The CIRG model offers a replicable and profitable approach to improve rural livelihoods while addressing food security and ecological balance.

Keywords: Azolla, Goat, Green fodder, Maize, Poultry

THE IFS model optimizes resource use by integrating various agricultural components. It promotes resource reuse, minimizes waste, sustains soil health and water use, and reduces reliance on external inputs. Circular agriculture economy concept, a long-standing practice in India, focuses on efficient resource use, incorporating practices like mixed crop-livestock farming, agroforestry, and water recycling. This model significantly reduces input costs and enhances sustainability. In contrast, high intensive, specialized agriculture (such as specialized livestock farming/ mono-cropping, large scale mechanized farming) primarily aims at maximizing profit at the cost of ecological balance leading to depletion of resources and generation of large quantities of waste and land degradation through use of inorganic fertilizers.

Considering that over 67% of Indian farmers are belonging to marginal category, with an average landholding of only 0.4 ha, ICAR-CIRG has developed a goat-based IFS model specifically designed to meet the needs of these farmers. The components of the developed

IFS model include 20 Goats and followers, 250 chicken, 3 azolla units, 3 vermi-compost units and 0.4 hectare of land for feed and fodder cultivation. It aims to sustain and double the marginal farmers' income by integrating different farm components. The developed IFS model was tested and performance of the different components were studied for a period of 30 months.

Goat and poultry component

A total of 20 adult female Barbari goats including two males are foundation stock for this IFS model. The goats are reared under semi-intensive system with hard soil floor houses. The goat houses and poultry hatches/shed are constructed adjacent to each other. The small window like provision is made between these houses and poultry is allowed to enter the goat houses for scavenging the left out goat feeds and fodder after goats are sent for grazing. The goats were bred in both the spring and autumn breeding seasons. The young ones are sold at one year of age after retaining the replacement stock and excess milk produced was also sold.

Vermi-compost production

The waste from goat farm and poultry farms are used either for directly fertilizing the agriculture field or converted into vermi-compost which can be used as fertilizer in the farm as well as can be sold. Three to Four tonnes of vermi-compost is produced in three-month period from the vermi-compost unit and hence a total of 10-12 tonnes of vermi-compost is expected annually.



Poultry component of IFS model



Eggs produced from poultry component



Azolla produced from azolla units



Vermicompost produced from vermicompost units



Goat component of IFS model

Total goat kids produced in 30 months by 20 female goats:	127 one year old kids for sale
Total birds sold :	534 numbers
Total number of eggs produced:	More than 33,000 eggs
Total manure availability:	60 tonnes and 15 tonnes each from goat and poultry in 30 months. (55 tonnes available for sale)
Total green fodder produced:	<i>Kharif:</i> 76 q <i>Rabi:</i> 195 q
Total grains produced:	<i>Kharif:</i> 7.65 q <i>Rabi:</i> 6.52 q
Vermi-compost produced:	10-12 tonnes
Azolla produced:	One kg daily (except peak winter)

Annual employment generation: 312 man-days

Azolla as poultry feed supplement

Readymade plastic ponds of 8'× 4'× 1' size were installed for cultivation of azolla. After introducing culture in the pond, azolla filled the pit within 7-10 days. However, during peak winter, azolla production reduced due to dormancy. During other parts of the year, about 1.0 kg of azolla was harvested daily from the pond which was used as poultry feed supplement.

Employment generation

Annual man day employment generated in Goat based Integrated farming system is higher, i.e. 312 man days (goat rearing stall 2.5 h per day + 0.5 h per day vermi-compost and azolla), poultry (2.0 h/day) and fodder production (1.84 h per day) as compared to taking up individual activities of only cultivation of one acre of land (84 man days), goat farming with 20

goats and its followers (228 man days), rearing 250 desi improved chicken (91 man day).

Conservation of soil

The intensive fodder production technology for feeding the goats was formulated through intercropping of legumes and cereals so that the soil fertility is maintained and the requirements of the goats are fulfilled.

Land capacity

Capacity of land (0.4 hectare or one acre) to sustain the fodder requirement of the 20 adult female goats and its followers are given in Table 1 and Table 2.

The net return over the total costs was Rs. 32314/- per month from goat-based IFS model (Circular Agriculture/ Economy) as compared to Rs. 19855/- from

Table 1. Best crop combination techniques of different cereals-legumes crop for *kharif* season

Best crop combination	Area cultivated	Non leguminous green produced (kg)	Leguminous green produced (kg)	Total green produced (kg)
Maize: cowpea (2:1)	605 sq. m	1,770	520	2,290
Sorghum: Cowpea (2:1)	605 sq. m	2,170	500	2,670
P. millet: C Bean (2:1)	605 sq. m	2,200	440	2,640
Grand total	1,815 sq. m	6,140	1,460	7,600
Hybrid Napier as green fencing of the area provides additional green fodder for lean period.				
Maize grain production	1,700 sq. m	Total grain production: 765 kg		

Table 2. Best crop combination and agro-techniques of different cereals-legumes crops for *rabi* season

Best crop combination	Area (sq. m)	Green fodder produced (kg)			Grain yield (kg)
		Cereals	Leguminous	Total	
Oat + Berseem (2:1)	560	2,585	1,150	3,735	-
Barley + Berseem (2:1)	560	-	1,100	1,100	175
Berseem - 25 kg seed and 100 kg P ₂ O ₅ per ha	1,456	-	11,425	11,425	-
Barley - 125 kg seed and 75 kg N per ha	1,424	3,285	-	3,285	477
	4,000	5,870	13,675	19,545	652
Hybrid Napier as green fencing of the area provides additional green fodder for lean period.					

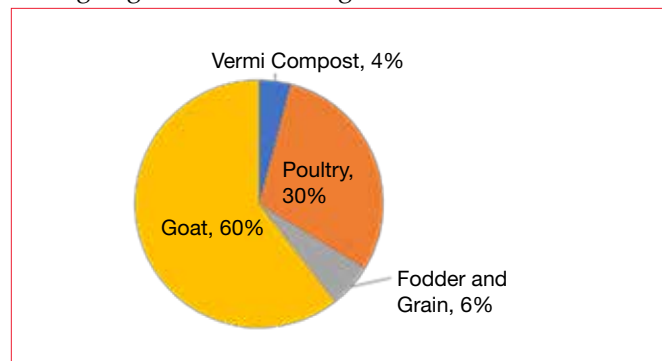


Fodder component of Goat based IFS model

Table 3. Net return from goat based integrated farming vs goat farming and poultry farming

Particular	Linear economy		Circular economy
	Only goat farming	Only Poultry farming	IFS Approach (Goat + Poultry)
Goat component	2,38,263	-	2,34,503
Poultry component	-	72,071	1,14,935
Vermicompost	-	-	16,000
Fodder and grain component	-	-	22,328
Total net returns per year	2,38,263	72,071	3,87,766

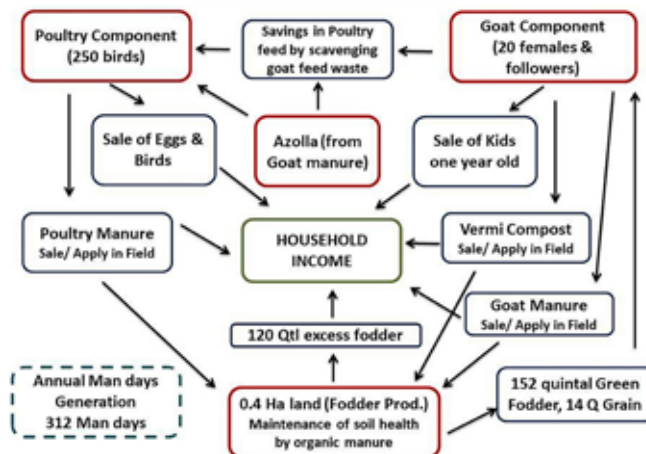
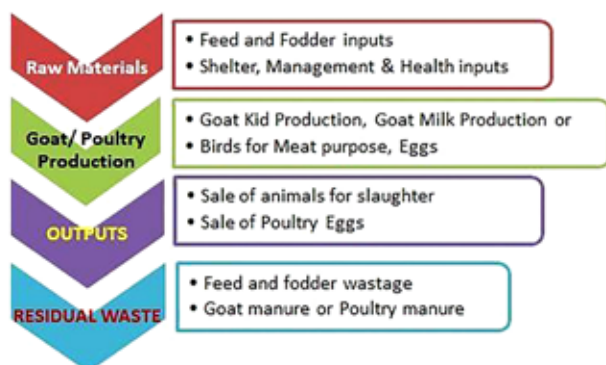
only goat rearing and ₹6,006 in case of rearing only poultry (Linear/Mono Agriculture/Economy). Based on the techno economic feasibility analysis, the results obtained from two- and half-year study of Goat plus Poultry Model shows that the net return over the total costs from Goat based IFS model with 20 goats and 250 poultry birds were found to be higher than that of the present national average income of marginal farmers through agricultural farming.



Percent of income from different components of goat based IFS

Eventhough different IFS models are extensively followed in many parts of country, they focused mainly on multiple crop-based models with animal husbandry as a subsidiary enterprise. CIRG team developed, for the first time, the Goat based IFS model wherein more than 50% of the income was derived from goat component with poultry and land/ fodder production playing

Linear Economy (Specialized farming) like only Goat farming or Poultry farming



Goat based integrated farming: Circular economy model

subsidiary roles. Uniqueness of this model is that it can be widely practiced in semi-arid and arid regions of the country wherein agriculture is uncertain profession due to erratic rainfall and recurrent draughts, and rural livelihood is mainly dependent on small ruminants like sheep and goats.

SUMMARY

The goat-based Integrated Farming System (IFS) model developed by ICAR-CIRG has proven to be a viable solution for enhancing the income and sustainability of marginal farmers. By integrating goat farming, poultry rearing, vermicomposting, and azolla cultivation on small landholdings, this model maximizes resource utilization while reducing input costs and waste generation. It provides higher net returns and employment opportunities compared to standalone practices, ensuring year-round productivity. The system is especially suitable for semi-arid and arid regions, where agriculture faces uncertainties. This approach offers a sustainable and replicable pathway to improve rural livelihoods and address ecological and economic challenges effectively.

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