

Empowering Rural Youth through the ARYA Project: Implications for Agriculture and Migration in Haryana, India

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ABSTRACT

Unemployment among rural youth often leads to migration to cities. This study assesses the impact of the ARYA (Attracting and Retaining Youth in Agriculture) Project in Haryana with a sample size of 30 rural youths. Under the project, youths were trained and supported to adopt enterprises such as mushroom production, fishery, and backyard poultry, along with allied activities like value addition and beekeeping. The results show a substantial improvement in income and employment, with average net income increasing by 147.62% in poultry, 111.82% in mushroom cultivation, and 56.20% in fishery. Enhanced technical, managerial, and marketing skills contributed to better enterprise performance and job creation. Overall, the ARYA Project effectively empowered rural youth, strengthened agri-based livelihoods, and helped reduce rural-to-urban migration.

Key words: Mushroom cultivation, Unemployment, ARYA Project, Livelihood

Introduction

Agriculture continues to be the cornerstone of global food security and economic development, supporting livelihoods and fostering sustainable growth. In India, agriculture has historically formed the backbone of the economy; however, rapid urbanization and increasing population pressure have adversely affected the sector (Kumari and Shirisha, 2021). Youth engagement in agriculture is critical, as young people represent the future of food systems and natural resource management. Despite agriculture's central role in ensuring food security and economic stability, it has become less appealing to younger

generations due to perceived low profitability, labour-intensive practices, limited access to modern technologies, and inadequate educational and institutional support.

The sector is further constrained by declining water availability, fragmentation of landholdings, soil nutrient depletion, and limitations in crop and vegetable production (Noopur *et al.*, 2023a), alongside the growing attraction of non-farm employment opportunities. These challenges have contributed to a shrinking agricultural workforce and accelerated rural-to-urban migration. Addressing these issues requires the promotion of sustainable farming practices, strengthened support for small and mar-

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ginal farmers, adoption of organic farming systems (Panwar *et al.*, 2021), and targeted investments in rural infrastructure and development.

Migration is a global phenomenon with both positive and negative socio-economic consequences (Krishna, 2022). While migration functions as an adaptive livelihood strategy, it is shaped by social norms, household composition, gender relations, social networks, and income-generating opportunities (Paraganiha, 2006). In India, rural-to-urban migration has intensified due to socio-economic and demographic transitions, resulting in urban population imbalances and increased pressure on urban infrastructure and services (Chakraborty, 2021).

India, as the youngest nation in the world, possesses a substantial youth workforce with significant potential to contribute to agricultural development; however, youth participation in agriculture has been steadily declining. In response, the Indian Council of Agricultural Research (ICAR), in collaboration with state agricultural departments, has undertaken initiatives to encourage youth involvement through innovation-driven and diversified agricultural enterprises. Notably, the ARYA (Attracting and Retaining Youth in Agriculture) programme was launched to address declining youth engagement in agriculture by promoting agripreneurship, skill development, and sustainable livelihood opportunities for rural youth (Som *et al.*, 2018).

The ARYA programme is strategically designed to strengthen the capacity of rural youth by providing technical training, enterprise-based support, and institutional linkages, thereby enhancing employment generation, income diversification, and long-term sustainability within the agricultural sector.

Methodology

The study was conducted in the Gurugram district of Haryana state to assess the impact of the ARYA (Attracting and Retaining Youth in Agriculture) programme on selected agro-enterprises. A total of 30 farmers/youth beneficiaries were selected using a cluster sampling approach from ARYA-implemented villages across selected blocks of Gurugram district.

Result

Youth participants were subjected to a systematic screening process that assessed educational qualifi-

cations, age, personal attributes, and availability of resources to ensure suitability for the selected enterprises. An inclusive and enabling environment was created through a series of consultative workshops aimed at sensitizing participants to the project objectives and promoting collective engagement.

The programme was formally initiated with an inception workshop that featured experienced and successful entrepreneurs, which facilitated knowledge exchange and encouraged open dialogue among participants. Structured discussions on enterprise potential, opportunities, constraints, and role delineation were complemented by participatory group exercises, thereby strengthening participants' understanding of enterprise development and project responsibilities.

This comprehensive and participatory approach ensured adequate preparatory grounding of the beneficiaries, thereby establishing a strong foundation for effective project implementation and contributing to sustainable enterprise development at the district level.

The methodology adopted for this study followed a systematic and participatory approach. Initially, villages were identified through diagnostic field visits and consultations with key stakeholders, including farmers, rural youth, extension personnel, and agricultural officials. The study commenced with a benchmark survey and market and supply chain analysis to assess prevailing economic activities and enterprise feasibility. Based on these assessments, four enterprises Mushroom cultivation, Fishery, Poultry, and Apiary were identified for intervention. However, the apiary enterprise was excluded from the impact assessment due to its relatively longer gestation and establishment period.

Community participation was ensured through a series of Focus Group Discussions (FGDs) conducted with rural youth across the selected villages. These FGDs facilitated the identification of 30 eligible youth beneficiaries, who expressed interest in adopting the selected enterprises. The discussions provided critical insights into the aspirations, constraints, and entrepreneurial motivations of rural youth. Final selection of respondents was refined through structured personal interviews, which captured socio-personal and resource-related information such as age, educational status, and availability of physical and financial resources.

The primary objectives of the study were twofold. First, to develop a cadre of 30 agro-entrepreneurs

capable of serving as role models and brand ambassadors for the identified enterprises Mushroom, Fishery, and Poultry thereby facilitating enterprise upscaling and dissemination. Second, the study aimed to develop easily adoptable agro-entrepreneurship models that encourage unemployed rural youth to adopt improved technologies and sustainable farming practices, thereby enhancing livelihood opportunities within the agricultural sector.

To evaluate the impact of the ARYA programme, economic performance indicators were assessed for the selected enterprises under two conditions before and after adoption of ARYA interventions. The indicators included:

- (i) Average Production,
- (ii) Average Annual Production, and
- (iii) Average Cost of Production (Rs./unit/year).

Youth Participation under the ICAR-ARYA Initiative

Youth participation in Mushroom, Fishery, and Poultry enterprises under the ICAR-ARYA initiative exhibited variation across age groups, indicating enterprise-specific preferences. The majority of participants belonged to the economically active age categories, reflecting the suitability of these enterprises for productive youth engagement. Educational analysis revealed that high school-educated youth constituted the dominant proportion across all three enterprises, suggesting that ARYA-supported enterprises are accessible to moderately educated rural youth.

Gender-wise participation indicated a predominance of male beneficiaries, highlighting persistent gender disparities in agri-entrepreneurship and underscoring the need for targeted interventions to enhance female participation (Noopur *et al.*, 2021). Additionally, caste-wise distribution reflected social differentiation among participants, emphasizing the importance of customized and inclusive strategies to broaden participation. Overall, the findings underscore the necessity of nuanced and context-specific interventions to promote inclusivity and balanced youth engagement in agricultural development programmes.

Enterprise-wise Progress under ICAR-ARYA (2019–20 to 2022–23)

Over the four-year period from 2019–20 to 2022–23, the ICAR-ARYA project achieved notable progress in promoting agro-entrepreneurship among rural

youth. As presented in Table 2, a total of 30 youth beneficiaries were provided need-based training and start-up support across three selected enterprises. These interventions resulted in the establishment of 30 functional entrepreneurial units, reflecting the effectiveness of tailored capacity-building and enterprise support mechanisms under the programme.

Performance of Mushroom Enterprise under ICAR-ARYA

The mushroom enterprise demonstrated substantial improvements in productivity, profitability, and employment generation as a result of targeted interventions under the ICAR-ARYA programme. Mechanization and input support significantly enhanced operational efficiency, leading to a reduction in cultivation costs of approximately Rs. 35,000 per annum. Additionally, value addition through processing of fresh mushrooms generated an additional income of Rs. 10 per kg, contributing to higher net returns for youth entrepreneurs.

A key sustainability-oriented intervention was the establishment of vermicompost units using spent mushroom substrate, which promoted efficient waste recycling, reduced input dependency, and enhanced overall economic returns. The adoption of improved cultivation practices, supported by training, quality inputs, and continuous technical guidance, resulted in a 50 per cent increase in average paddy straw mushroom production per bed over the four-year period of project implementation.

The economic performance of the mushroom enterprise showed a progressive upward trend. The Benefit–Cost (B:C) ratio increased from 1.25 at the initial stage to 2.58 during 2022–23, reflecting substantial improvement in enterprise profitability. Employment generation under this enterprise also exhibited consistent growth, with the average annual employment generation increasing by 212.5 per cent over the study period. This substantial increase can be attributed to enterprise expansion, adoption of scientific production techniques, and capacity-building initiatives facilitated under the ARYA programme. These findings corroborate earlier studies emphasizing the importance of vegetables, including mushrooms, as significant contributors to food and nutritional security (Noopur *et al.*, 2023b).

Performance of Fishery Enterprise under ICAR-ARYA

The fishery enterprise recorded notable progress

159,000 in 2021-22. By 2022-23, the average net return had reached Rs. 366,000 per unit per year, reflecting significant improvement in productivity and profitability. Similarly, in the Fishery enterprise, the average net return per hectare per year increased consistently, from Rs. 1,27,000 in 2018-19 to Rs. 2,58,900 in 2022-23 among the same 30 youth participants. These trends demonstrate the positive impact of ARYA interventions in enhancing enterprise performance, resource utilization, and livelihood outcomes for rural youth.

The ARYA project significantly improved financial performance and livelihoods among 30 youth participants. In the Fishery enterprise, average net returns increased from Rs. 1,27,000 in 2018-19 to Rs. 2,58,900 in 2022-23, while Backyard Poultry returns rose from Rs. 6,800 to Rs. 1,44,670 over the same period, reflecting enhanced profitability, productivity, and employment generation. The project's outreach impacted 46 villages for mushroom, 36 for fishery, and 28 for poultry, supported by media campaigns, demonstrating its effectiveness in promoting youth-led, sustainable agricultural enter-

prises and rural economic development

The ARYA project achieved notable outreach through digital dissemination, with technologies shared on YouTube (8 for mushroom, 14 for fishery, and 6 for poultry), and improved migrant livelihoods, benefiting 4, 6, and 2 migrants in mushroom, fishery, and poultry enterprises, respectively. Enterprise-wise economic analysis shows the highest increase in average net income in poultry (147.62%), followed by mushroom (111.82%) and fishery (56.20%). The comparatively lower growth in fishery income is attributed to higher initial investment and a longer gestation period, particularly in the first two to three years.

The correlation analysis (Table 4) indicates significant positive relationships between key economic performance indicators and entrepreneurial competencies. Gross turnover ($r = 0.695$), per day income ($r = 0.712$), net income ($r = 0.900$), B:C ratio ($r = 0.734$), and employment generation ($r = 0.716$) showed statistically significant positive correlations, highlighting that better-performing enterprises tend to demonstrate stronger entrepreneurial skills, par-

Table 2. Economic Impact on Mushroom, Fishery, and Poultry Enterprise after 4 years of inclusion

Enterprise	Measurable Indicator	Before (2018-19)	2019-20	2020-21	2021-22	2022-23	% Change
Mushroom	Avg. production of paddy straw mushroom (kg/bed)	0.60	0.708	0.82	0.85	0.90	50.00
Fishery	Avg. body weight of fish (kg)	0.520	0.650	0.740	0.780	0.830	59.62
Poultry	Avg. body weight (kg/bird)	1.80	1.90	2.00	2.25	2.25	25.00
Mushroom	Avg. annual production (kg/unit/year)	864	1065.54	2131.60	3320	5100	490.28
Fishery	Avg. fish production (q/ha/year)	22.75	28.24	33.46	36.82	41.50	82.42
Poultry	Mortality (%)	24	12	10	4	4	“83.33
Mushroom	Avg. cost of production (Rs./unit/year)	69,120	79,765	1,50,710	1,85,000	2,22,000	221.18
Fishery	Avg. cost of production (Rs./unit/year)	1,60,500	1,75,300	2,02,400	2,21,000	1,97,600	23.12
Poultry	Avg. cost of production (Rs./unit/year)	14,800	23,400	54,000	1,15,050	1,58,225	969.08
Mushroom	Avg. gross return (Rs./unit/year)	86,400	1,06,554	2,38,692	3,44,400	5,88,000	580.55
Fishery	Avg. gross return (Rs./unit/year)	2,87,500	3,37,800	3,98,500	4,39,800	4,56,500	58.78
Poultry	Avg. gross return (Rs./unit/year)	21,600	37,150	90,000	2,04,790	3,02,895	1302.29
Mushroom	Avg. net return (Rs./unit/year)	17,280	26,789	87,982	1,59,000	3,66,000	2018.05
Fishery	Avg. net return (Rs./unit/year)	1,27,000	1,62,500	1,96,100	2,18,800	2,58,900	103.85
Poultry	Avg. net return (Rs./unit/year)	6,800	13,750	36,000	89,740	1,44,670	2027.50
Mushroom	B:C Ratio	1.25	1.33	1.58	1.86	2.58	106.40
Fishery	B:C Ratio	1.79	1.92	1.96	1.99	2.31	29.05
Poultry	B:C Ratio	1.45	1.58	1.66	1.78	1.91	31.72
Mushroom	Avg. employment generation per annum (man-days)	96	100	164	192	300	212.50
Fishery	Avg. employment generation per annum (man-days)	97	108	112	115	123	26.80
Poultry	Avg. employment generation per annum (man-days)	14	25	45	75	75	435.71

ticularly in financial and human resource management (Kaur *et al.*, 2021). In contrast, operational duration exhibited a weak and non-significant negative correlation ($r = -0.115$), suggesting that longer enterprise operation does not necessarily translate into improved entrepreneurial competencies.

Discussion

The Attracting and Retaining Youth in Agriculture (ARYA) programme of ICAR aims to address declining youth participation in agriculture through capacity building, institutional support, and enterprise development. Implemented through Krishi Vigyan Kendras (KVKs), the programme trains 200-300 youths below 35 years in agriculture and allied enterprises such as mushroom cultivation, poultry, fisheries, dairy, and goat rearing, while promoting value addition, processing, and market linkage (Sayana *et al.*, 2022). ARYA-trained youths often act as role models and catalysts for agri-based start-ups in rural areas (Alok *et al.*, 2021).

Significant economic gains were observed across enterprises. Mushroom cultivation recorded substantial increases in production, employment generation, and profitability, supported by strong mar-

ket linkages, skilled labour, and quality inputs (Sahoo *et al.*, 2023). Backyard poultry, particularly managed by women, yielded higher incomes due to low investment needs, improved breeds, effective health management, and assured market demand (Jaishankar, 2020; Pal *et al.*, 2022). Fish farming emerged as a sustainable livelihood option, generating employment across production and value chains, with additional income from value-added products (Singh *et al.*, 2020; Chandre Gowda, 2023).

Despite these benefits, adoption constraints such as high input costs, limited technical knowledge, and marketing challenges persist among rural youth (Sayana *et al.*, 2022). KVK interventions, including institutional linkages, access to subsidies, and market facilitation, play a critical role in overcoming these barriers and strengthening youth-led agri-entrepreneurship (Sandhu and Chauhan, 2020).

Conclusion

The impact assessment under the ICAR-ARYA initiative highlights active youth engagement in mushroom, fishery, and poultry enterprises, underscoring the need for targeted interventions to address enterprise-specific preferences and socio-economic dis-

Table 3. Impact of the ARYA Project on Agricultural Enterprises in Local Communities

Impact after inclusion in ARYA	Mushroom	Fishery	Poultry
Farmers in the village started this enterprise (No.)	18	12	6
Number of neighboring villages in which the enterprise has spread	46	36	28
Number of migrants benefitted	4	6	2
Products branded (No.)	1	0	0
Publications (No.)	3	4	2
Awareness created by the group (Press release/TV/Radio, etc.) (No.)	12	18	10
WhatsApp group created (No.)	1	1	1
Groups created (No.)	1	1	1
Technologies and success stories uploaded on YouTube (No.)	8	14	6

Table 4. Correlation (r) between economic performance and entrepreneurial competencies

Economic performance indicators	Total entrepreneurial competencies	Operational & marketing competencies	Financial competencies	Human resource management competencies
Operational duration	-0.115	0.959**	-0.301	0.729**
Gross value of inputs used	0.213	-0.331	0.965**	0.307
Gross turnover	0.695*	0.064	0.023	0.422
Per day income	0.712*	0.365	0.088	0.495
Net income	0.025	0.900**	-0.116	0.700**
B:C ratio	-0.119	0.734*	0.741*	0.834**
Employment generation	0.716*	-0.274	0.818**	0.956**

parities, particularly related to gender and caste. Over the four-year period (2019–20 to 2022–23), the programme successfully trained and supported young entrepreneurs, leading to the establishment of multiple entrepreneurial units and consistent improvements in average net returns, thereby enhancing profitability, economic sustainability, and local employment. Market connectivity was strengthened through exposure visits and branding of mushroom products under the ARYA label, while sustainable practices such as fish seed production and biofloc systems addressed market demands in fisheries. In poultry, the initiative emphasized increased participation of women through Self-Help Groups and the establishment of local feed processing units. Overall, the findings provide valuable insights for policymakers and stakeholders aiming to promote inclusive, sustainable, and youth-led agri-entrepreneurship.

Conflict of Interest- None

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