Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

Special Issue 2021, Volume-34, Page 1-10

# Hill agricultural management practices, energy, and monetary efficiencies of shifting agricultural systems in Arunachal Pradesh

Ayyanadar Arunachalam*

Arunachal University of Studies, Namsai, Arunachal Pradesh
*Present Address: ICAR-Central Agroforestry Research Institute, Jhansi 284003, Uttar Pradesh

ARTICLE INFO

*Article history*:
Received: 10th September 2021
Revision Received: 21st September 2021
Accepted: 28th October 2021

----------------------------------------------

*Key words*: *Jhum, Hill Agriculture, Arunachal Pradesh*

----------------------------------------------

ABSTRACT

Intensive agriculture has ensured increased productivity per unit area in our country. However, this form of agricultural ecosystem management will not be suitable for resource constraints and remote locations like the hilly terrain of Arunachal Pradesh. This paper draws in a systematic comparison of the western and eastern part of Arunachal Pradesh in terms of crop production systems under jhum, soil and nutrient management, energy and monetary efficiencies of the production system along with the demographical village ecosystem analysis. The Sagalee Hill in western Arunachal Pradesh has a higher literacy rate compared to the Namasai region in eastern Arunachal Pradesh. Meanwhile, the difference in the cropping production system and agricultural management varied between the western and eastern sites is in terms of the choice and number of the crops. In terms of energy efficiency and yield, the eastern part performed better compared to its counterpart and there might be potential linkage with the better animal husbandry practices in the eastern region. There was no difference in the plant diversity between the two regions which must be attributed to the biodiversity richness of the region. Overall based on the analysis of the present existing condition, the study insists that farmers, researchers, and agricultural scientists should encourage mixed cropping patterns in the Indian Himalayan region

## 1. Introduction

As land becomes a limiting resource, growth in agriculture depends more on yield per unit area through advancement in technologies. Increased output per hectare contributes about 70 percent of the major food production in developing countries. Over-exploitation of land and water resources and excessive and inappropriate use of chemicals during the past two decades have resulted in deteriorating soil health, creating a nutritional imbalance, disturbed natural hydrology and resurgence of pests and diseases, particularly in intensively irrigated areas (Grewal and Bhajan Singh 1989, Gulati and Sharama 1990). High input agricultural technology is useful when the basic ingredients are locally available, affordable, and maintainable. For subsistence farming on a smallholding with fragile resources, stepwise improvement based on low input is not only technically feasible but also culturally, economically, and ecologically desirable.

Although strategies for improving the cropping system depends largely on the specific needs of a particular agro-climatic region. Some of the urgent considerations would include is a greater emphasis on the inclusion of oilseeds, pulses, and fodder crops in these subsistence systems. The importance of including tree components, fodder grasses and legumes in the farming system for meeting the fuelwood and fodder needs is being increasingly felt. The demand for diversification of cropping systems will be

*Corresponding author: arun70@gmail.com

inevitable in the years to come. In the natural resource-rich environment, such as the state of Arunachal Pradesh in India, primitive agricultural practices dwell upon the majority of the livelihoods of local people. This paper describes the hill agricultural management practices in the State comparing two specific regimes viz. western and easternmost part of the State and it also comprehend the monetary and energy efficiencies within the functional framework of the village ecosystem.

**Agricultural management practices**

***Sagalee Hills in Arunachal Pradesh***

The western part of Arunachal Himalaya (Sagalee Hills) has a long history of subsistence economy, with agriculture being the core component, in which over 80% of the people are involved. Realizing the greater variation in the altitude, topography, climate and forest resources, availability of irrigation water, and socio-economic and cultural factors, one could reasonably expect a variety of land use patterns in the region. If ecological conditions are superimposed on this, then the heterogeneity becomes very complex. Shifting agriculture which is a mixed crop farming system is predominant across a vast area between 300 m and 2500 m asl on sloping fields. These sloping cultivation systems are carved out from the mountain slopes, sometimes with a slope percentage greater than 50%. Mostly, the agriculture is practised under rainfed conditions. The traditional agroecosystem of this region is mainly operated by human labour in which women plays a crucial role. Cropping patterns were built around two seasons locally preferred to as Kharif (rainy season) and Rabi (winter season). *Echinochpoa frumentacea*, maize (*Zea mays*), soybean (*Glycine max*), finger millet (*Eleusine coracana*), gingelly (*Sesamum indicum*) and beans (*Phaseolus radiatus*) were dominant rainy season crops. Wheat (*Triticum aestivum*), barley (*Hordeum vulgare*) and rapeseed (*Brassica campestris*) were dominant crops for the winter season. A plot owned by a family was divided into several sub-plots locally called 'Khet' varying in size from 25 $m^2$ to 100 $m^2$.

Agriculture in the hilly area is not easily adapted to industrialized techniques, partly because of the topography and partly because of socio-economic considerations. In the face of the prevailing environmental conditions, with natural resources declining at a rapid rate, the efficiency and sustainability of the hill agroforestry component and efficient biomass utilization employing appropriate technological input. Such technologies should build upon the empirical knowledge of the local people and their perceptions. This type of approach would be appreciated by the local communities and would readily find their acceptance and effective participation in the program (Semwal and Maikhuri 1996).

A mid-altitude (700-1200 m asl) village in the western part of Arunachal Himalaya was analyzed in terms of soil management practices. Though several studies on Himalayan agroforestry system are available (Toky et al. 1998, Gilmour and Nurse 1991, Sundriyal et al. 1997 Semwal and Maikhuri 1996, Singh et al. 1997), knowledge on ecosystem diversity within the village landscape and linkages between different ecosystem types and efficiency of the different land-use system is fragmentary.

Although sustainable agriculture has been defined as a practice that involves the successful management of resources of agriculture to satisfy human needs while maintaining or enhancing the quality of the environment and conserving natural resources, the overall goal of agriculture and forestry research has been to increase food, fibre and timber production, the sustainability concerns have been yield, yield stability and economic viability (Spencer et al. 1992).

Due to limited options, the cultivator in the area is forced to put most unfavourable marginal land to productive use for self-sustenance and thus aggravated the ecological problems. As at present, the alternative approaches to solving these problems are complex and one also needs to understand the traditional technologies/ knowledge system which was providing the subsistence to hill farmers, their importance in application to manage existing soil/ land use.

Soil losses are the first and the foremost problem in the Himalayas, which is causing siltation problems in the plains. The loss of productive substrate is both due to direct human development actions and indirect ecosystem change. The direct human development action pertains to cultivation where tilling makes the soil prone to erosive processes, as the vegetal cover is limited, and the slopes are more intense. Other development activities like infrastructure development demand land more likely suitable or land put to agriculture. In the ongoing pressure for land, road construction has encroached from cutting of road on the agriculture field occurring by the side, making most of the productive soil/ land unproductive (Saxena et al. 1994).

***Namsai Region of Arunachal Pradesh***

Traditionally jhum has been the chief land use in the humid tropical area, along with valley land agriculture where topography would permit it (Ramakrishnan 1985a). The terrace cultivation is introduced in this region which has however been largely rejected both under the given ecological and socio-economic considerations.

At Namsai, the jhum practised by the Tai Kampti and Singpho tribes, which alone involve cutting of the forest vegetation. The jhum cycle (the length of the fallow period between two successive croppings at the same site) ranged between 5 and 60 years, with a more frequent 5-years cycle

(Toky and Ramakrishnan 1981). The average size of the jhum plot ranged between 1.5 and 2.5 ha for an average family of six to seven members. The sowing of 25-33 crop species is done in February, but sequential harvesting is completed by the end of July.

Wet rice cultivation is done in valley land every year with one or two croppings by the indigenous communities. Since valleys are rich with nutrient wash-out from the high hill slopes, only a small quantity of the organic manure (123-170 kg $ha^{-1}$) is applied. The first cropping of rice is done between July and November, by transplanting seedlings raised separately in a nursery. The land is fallowed between December and January. Second cropping, if done (as by the Karbis), is a mixture of rice and maize rose between February and June, but the seed is broadcast. Bullock is used for ploughing.

*Brassica campestris* is cultivated by the local people of the State between October and February on flat land as a monoculture. Initially, the weedy growth is slashed and ploughed in, and the seeds are broadcast. *Brassica compestris* may also be raised as a Kitchen Garden by the Karbis, in much smaller plots.

Poultry, goat, swine, cattle and Mithun rearing are the animal husbandry practices of the different communities. Poultry is based on scavenging by the animal within the village boundary. Swine husbandry is based on the recycling of detritus from agriculture, though the Karbis do not rear pigs. Cattle are raised for meat by the Nyishis, whereas the karbis and the Chakmas rear them for milk. Mithun (*Bos frontalis*) is a traditional animal reared only by the Nyishis for meat. The Kacharis and the chakmas do not rear goats. Goats, cattle and Mithun largely browse/ graze in the forest.

The different tribe's lives in raised platform houses made of locally available bamboo, arecanut leaf, thatching grass (*Imperata cylindrica*) and timber of *Mesua ferrea* and *Macaranga denticulata*. Fuelwood drawn from the forest is used for cooking; wild plant and animals are collected for human and animal consumption. House construction material is also obtained from the forest. Agriculture and animal husbandry, especially piggery are the major food production system in the village. Human labour is the major output from the domestic sector and is used for all village activities.

**Soil management**

In the absence of possibilities for horizontal expansion and the urgent need for the rapid increase in agricultural production, vertical growth in agriculture through intensive multiple cropping is the only alternative to meet the relentless demand for higher food production. Farmer's know-how to practice multiple cropping and the researchers only trying to improve these systems, taking into consideratior management decision based on a complex array of factors relate soil fertility and plant nutrition. It is well known that soil tenc decline in productivity when they are continuously cropped wit adopting satisfactory and restorative practices. Therefore thorough understanding of the basic principles of soil and management is essential for developing appropriate soil fert management techniques based on sound principles resulting in input sustainable cropping system.

**Integrated nutrient management**

The concept of integrated nutrient management (INM) is the improvement and maintenance of soil fertility for sustaining increased productivity through optimizing all possible organic, inorganic, and biotic sources of plant nutrients required for crop growth and quality in an integrated manner appropriate to each cropping system and the farming situation in its ecological, sociological, and economic possibility. The basic principle behind this concept is to use both the chemical fertilizer and organic manures most efficiently because of their limited availability and higher prices. The integrated use of organic manures and mineral fertilizer is promising in maintaining stability in crop production on certain soil through correction of marginal deficiencies of secondary and micronutrient elements in course of mineralization of organic manures on the one hand and providing favourable physical, biological and soil ecological condition on the other (Tangjang et al. 2013). Thus, integrated nutrient management involving inorganic manures, bioinoculants (biofertilizer) and nutrient solubilizer with organic residue has shown greater potential in stabilizing the yield of field crops over a period to provide the ideal nutrition for a cropping system through a proper combination of various nutrient resources, their optimum utilization and maintenance of soil productivity and ecology on a sustainable basis.

**Table 1.** Structure of village ecosystems in the study sites

| Parameters | Sagalee Hills | | | Namsai Region | | |
|---|---|---|---|---|---|---|
| | I | II | III | I | II | II |
| **Demography** | | | | | | |
| Household | 65 | 57 | 95 | 30 | 46 | 48 |
| Population | 327 | 360 | 694 | 218 | 185 | 198 |
| Male | 166 | 193 | 336 | 100 | 102 | 109 |
| Female | 161 | 167 | 358 | 118 | 83 | 89 |
| Average family size | 5 | 6 | 8 | 6 | 5 | 6 |
| **Literacy (%)** | 68 | 72 | 61 | 48 | 53 | 42 |
| Agriculture system | Jhum | Jhum | Jhum | Jhum | Jhum | Jhum |
| **Animal husbandry** | | | | | | |
| Cow | 2 | 8 | 10 | 42 | 37 | 28 |
| Goat | - | 15 | 9 | 54 | - | 47 |
| Pig | - | - | - | 78 | 87 | 108 |
| Buffalo | 24 | 18 | 58 | - | - | 4 |
| Poultry birds | 12 | - | - | 53 | 40 | 96 |
| **Infrastructure** | | | | | | |
| School | 3 | 4 | 2 | 1 | 2 | 1 |
| No. of dispensary | 1 | 1 | - | 1 | 1 | 1 |
| Market Distance (km) | 1.4 | 1.2 | 2 | 2.2 | 1.68 | 0.96 |
| Income source | AG+S | AG+S | AG+S | AG+S | AG | AG+S |

**= Service, (-) indicating no data available**
*** Data are based on villager's interview.**

**Village Ecosystem Analysis**

The functional village ecosystem of traditional societies is based upon the recycling of resources within the system using human and animal labour as major energy input. However, modern agriculture *i.e.,* using chemical fertilizer, pesticides, fungicides, high yielding varieties improved the efficiency in terms of time and human labour, but suffers from an energetic viewpoint. In both the Himalayan sites, villagers are fully dependent on agricultural practices, but the living standard was not increasing rapidly. In the western part of Arunachal Himalaya, literacy percentage was high in comparison to Arunachal Himalayan sites **(Table 1)**. In the western part of Arunachal Pradesh, the sites had two seasonal crops being cultivated peripherally for their food grains **(Table 2)**. In the east most part of Arunachal, the sites preferred single crop in the traditional jhum (**Table 3).** In general, mixed cropping is practised in a 'jhum' kheti in Arunachal Pradesh, but in our selected site, it is not so. Not much difference was observed in the plant diversity across the region **(Table 4).**

The jhum cultivation systems have had a long history of subsistence economy, with agriculture being the core component, in which over 80% of the people are involved. The traditional agroecosystem of this region is mainly operated by animal power and human labour in which women play a crucial role. Rainfed agriculture mostly produces three crops every 2 years in the study area, while if irrigated, the land could hold two to three crops are taken in a year. In a year two major cropping seasons are recognized *i.e.* April- October and November-March **(Table 5)**. For soil management, farmers, researchers, and agricultural scientists should be given preference for mixed cropping patterns in the Himalayan region

**Table 2.** Cropping calendar of jhum cultivation in Sagalee Hills and Namsai Region

| | Crops | Sowing/ Planting | Weeding | Cultural Practices | Harvesting |
|---|---|---|---|---|---|
| Eastern | Paddy | May/July | June/August/ September | June/July/August/September | October |
| Western | Paddy/Mixed crops | November | January/ March | February/ December | April |

**Table 4.** Dominant tree species in the natural forests at study sites.(1.0;1.13)

| Western Himalayan Forest | Eastern Himalaya Forest |
|---|---|
| *Ailanthus grandis* | *Dipterocarpus macrocarpus* |
| *Canarium strictum* | *Shorea robusta* |
| *Cinnamomum tamala* | *Toona ciliata* |
| *Grewia optiva* | *Ficus spp* |
| *Dipterocarpus macrocarpus* | *Aegle marmelos* |
| *Duabanga grandiflora* | *Morus alba* |
| *Ficus spp.* | *Celtis australis* |
| *Mallotus philippensis* | *Grewia optiva* |
| *Punica granatum* | *Salix alba* |
| *Terminalia myriocarpa* | *Terminalia chebula* |
| *Pinus roxburghii* | *Terminalia bellerica* |
| *Aegle marmelos* | *Pinus roxburghii* |
| *Celtis australis* | |

The total energy invested for one cropping season was about 8955 MJ $ha^{-1}$ for wheat, 10357 MJ $ha^{-1}$ for paddy, 4615 MJ $ha^{-1}$ for mustard, 4356 MJ $ha^{-1}$ for soya bean in Sagalee hills and 7903 MJ $ha^{-1}$ for paddy in the Namsai region. The major input in the different agricultural systems was in the form of labour, which is provided by the farmers themselves or by the domestic animals **(Table 6)**.

## Conclusion

The state of Arunachal Pradesh in India has abundant natural resources, yet the hilly terrain is a challenge as well as the opportunity for practising agriculture to enable the State to be self-reliant. This study compared the crop production systems under jhum, soil and nutrient management, energy and monetary efficiencies of the production system along with the demographical village ecosystem analysis. The major difference between the two study sites will be in terms of the number and choice of crops which might have linkage with the literacy level and animal husbandry efforts. Still, the diversification of cropping systems will be inevitable in the years to come. Overall, the present analysis unveil the potential of the mixed cropping systems and that farmers, researchers, and agricultural scientists should encourage integrated farming practices in the Indian Himalayan region


## Acknowledgements

The author extends his gratitude to the Director-General, Indian Council of Agricultural Research for permission for enrollment in the DSc program at Arunachal University of Studies.


## References


Grewal and Bhajan Singh, 1989. Intensive farming in India. Indian J. *Agric.Sci.* 59:551-557.

Gulati, A. and Sharama, P.K.1990. Employment, foregion exchange and environment. Implication for cropping pattern. *Economic and Political weekly.* 25 (39): A111-A117 and A120-A124.

Maikhuri R.K., Rana U., Semwal R.L. and Rao K.S. 2000. Agriculture in Uttaranchal: issues and management prospects for economic development. In: Sati M.C. & Sati S.P. (Eds), *Uttranchal statehood: Dimensions of development.* Indus Publishing Company, New Delhi, Pp. 151-167.

Mishra, B.K. and Ramakrishnan, P.S. 1981. The economic yield and energy efficiency of hill agro0ecosystem at higher elevations of Meghalaya in north-eastern India. Acta Oecological/Oecol. Applic. 2 369-389.

Mitchell, R 1979. The Analysis of Indian Agro-ecosystems. Interprint, New Delhi. 180p.

Toky, O.P. and Ramakrishnan, P.S. 1981. Cropping and yields in agricultural systems of the north-eastern hill region of India. Agro-Ecosystems, 7: 11-25.

Saxena K.G., Rao, K.S., Pande, A., Rana,U., Sen, K.K,Nehal. and Manjila, B.S. 1994. Sustainable development: opportunities and constraints. *Himavikas Publication* No.6, Almora: G.B. Pant Institute of Himalayan Environment and Development.

Singh G. S., Rao K. S. and Saxena K.G., 1997. Energy and economic efficiency of the mountain farming system; a case study's in the north-western Himalaya. *Journal of Sustainable Agriculture* 9: 25.

Spencer, D.S.C. and Swift, M.J., 1992. Sustainable agriculture; definition and measurement. In *Biological Nitrogen Fixation and Sustainability of Tropical Agriculture*. Ed. K Mulongoy, M. Gueye, DSC Spencer. Chichester; John Wiley.

Sundriyal R.C., Rai S.C., Sharma E. and Rai Y.K., 1994. Hill agroforestry system in south Sikkim, India. *Agroforestry System* 26: 215-235.

Tangjang, S., Arunachalam, A., Arunachalam, K., Shukla, A.K. and Deb, S. (2013) Influence of plant residues, farm yard manure and inorganic fertilizers on soil N and P mineralization and growth of Abelmoschus esculentus Linn. Climate Change and Environmental Sustainability 1(2): 127-137

Toky O. P., Kumar P and Khosla P.K. 1989. Structure and function of traditional agroforestry system in the western Himalaya. A. Biomass and productivity. *Agroforestry system* 9: 47-70.

U.S. Department of Agriculture (USDA), Agricultural Research Service, USDA Nutrient Data Laboratory. 2000. USDA National Nutrient Database for Standard Reference, Release 15.

**Table 3**. Sequential sowing and harvesting of some important crops in the Arunachal Hills

| | | | I- Site | | II- Site | | III- Site | |
|---|---|---|---|---|---|---|---|---|
| Species | English Name | Local Name | Sow. | Har | Sow. | Har | Sow | Har |
| **Cereals and millets** | | | | | | | | |
| *Amaranthus* spp. | Amaranth | Chauli | May | Oct. | - | - | - | - |
| *Hordeum vulgare* | Barley | Jau | Nov. | April. | - | - | Nov. | Apr |
| *Echinochloa frumentosa* | Barnyard millets | Jhangora | - | - | Mar/Apr. | Oct. | Apr. | Sep |
| *Oryza sativa* | Paddy | Dhan | May | Oct | May | Oct | May | Oct |
| *Triticum aestivum* | Wheat | Gehun | Nov | Apr | Nov | Apr | Nov | Apr |
| *Zea mays#* | Maize | Makai | Mid-Jun | Aug./Sep | Jun | Aug | Jun | Sep |
| **Pulses** | | | | | | | | |
| *Glysine max* | Soya been | Soya bean | July | Oct | Jul | Oct | Jul | Oct |
| *Glysine soja* | - | Bhatt | July | Oct | Jul | Oct | Jul | Oct |
| *Pisum sativum* | Pea | Matar | Nov | Mar | Nov | Mar | Nov | Mar |
| *Vigna mungo* | Black gram | Kalidal | July | Oct | Jul | Oct | Jul | Oct |

*All crops not grown the entire respective site; # Crop grown in kitchen garden not for extensively for the use.

Sow.= Sowing of the crop, Har = harvesting of the crop

**Table 4. Energy and economic value of a few selected crops and labour**

| Name of the crops | Heat of combustion (Kcal.) | Energy value (M J $kg^{-1}$) | Rupees $kg^{-1}$ | Rupees $day^{-1}$ |
|---|---|---|---|---|
| Paddy [2] | 3429 | 14.4 | 4.5 (EH) | |
| Paddy [2] | 3429 | 14.4 | 6.5 (EH) | |
| Maize[1] | 3825 | 16.0 | 12.0 | |
| Mustard [1] | 5924 | 24.8 | 29.4 | |
| Vegetables (fresh) [1] | 574 | 2.4 | 6.0 | |
| Wheat | 4180 | 16.2 | 11.5 | |
| Soya bean | 690 | 17.1 | 16.0 | |
| Male (One man-day) [1] | | 1.89 | | 100.0 |
| Female[1] | | 1.44 | | 80.0 |
| One bullock day[1] (average value of different weight category) | | 9.13 | | 100.00 |

[1] Mitchell (1979)

[2] Mishra and Ramakrishnan (1981)

[3] USDA Nutrient Database for standard Reference, Release 15. (2000)

Labour in Man-days.

Daily energy for heavy work (all type of agricultural activities is considered under heavy work)

Male = 4520 kcal= 1.89x $10^7$ J

Female =3440 kcal= 1.44x$10^7$ J

Bullock = 21806.67 Kcal.

(average value of different weight categories) = 9.13 x$10^7$ J; Caloric values are from Mitchel (1979)

**Table 5.** Energy (MJ $ha^{-1}$) and monetary (rupees $ha^{-1}$) efficiencies agricultural agro-ecosystems in western and eastern Arunachal Himalaya

| Parameters | Category | WJC- mix crops | WJC-paddy | WJC-mustard | WJC- soyabean | EJC-Paddy |
|---|---|---|---|---|---|---|
| **Input** | | | | | | |
| Seed | Energy | 3460 ±160 | 3329 ±158 | 1560 ±226 | 1240 ±215 | 1938 ±340 |
| | Money | 1270 ±170 | 1590 ±130 | 590 ± 125 | 478 ±280 | 609 ±120 |
| Land preparation | Energy | 2665 ±138 | 2940 ±180 | 1210 ±130 | 1050 ±160 | 4850 ±1090 |
| | Money | 2158 ±240 | 2659 ±178 | 843 ±219 | 766 ±129 | 2098 ±387 |
| Plantation | Energy | 1290 ±285 | 2578 ±318 | 1130 ±147 | 1227 ±108 | 458 ±125 |
| and weeding | Money | 985 ±238 | 1630 ±410 | 470 ±58 | 635 ±98 | 503 ±122 |
| Harvesting | Energy | 1360 ±164 | 1510 ±128 | 715 ±138 | 839 ±157 | 630 ±223 |
| | Money | 1134 ±227 | 1542 ±386 | 790 ±365 | 684 ±296 | 1840 ±348 |
| Total | Energy | 8955 | 10357 | 4615 | 4356 | 7903 |
| | Money | 5547 | 7421 | 2693 | 2563 | 5050 |

*Continued…..*

| | | | | | | |
|---|---|---|---|---|---|---|
| **Output** | | | | | | |
| **Edible value** | | | | | | |
| WJC-Wheat | Yield (kg ha$^{-1}$) | 2250 ±986 | - | - | - | - |
| | Energy | 36450 ±1248 | - | - | - | - |
| | Money | 12025 ±693 | - | - | - | - |
| WJC-Paddy | Yield (kg ha$^{-1}$) | - | 2390 ±639 | - | - | - |
| | Energy | - | 34416 ±711 | | | |
| | Money | - | 15535 ±987 | | | |
| WJC-Mustard | Yield (kg ha$^{-1}$) | - | - | 873 ±257 | | - |
| | Energy | - | - | 21651 ±318 | | - |
| | Money | - | - | 25666 ± 429 | | - |
| WJC-Soya bean | Yield (kg ha$^{-1}$) | - | - | - | 1440±321 | - |
| | Energy | - | - | - | 24624±256 | - |
| | Money | - | - | - | 42336 ±176 | - |
| EJC-Paddy | Yield (kg ha$^{-1}$) | - | - | - | - | 2637 ±358 |
| | Energy | - | - | - | - | 37973 ±534 |
| | Money | - | - | - | - | 11867 ±1230 |
| **Residue** | | | | | | |
| **Crop** | Energy | 142659 | 104562 | 105671 | 113973 | 134817 |
| **Weed** | Energy | 782 | 964 | 829 | 956 | 724 |
| **Total** | Energy | 179891 | 139942 | 128151 | 139553 | 173514 |
| | Money | 12025 | 15535 | 25666 | 42336 | 11867 |
| **Efficiency** | Energy | 20.09 | 13.51 | 27.77 | 32.04 | 21.96 |
| | Money | 2.17 | 2.09 | 9.53 | 16.52 | 2.35 |

WJC – Western-Arunachal Jhum Cultivation; EJC – Eastern-Arunachal Jhum Cultivation