

Targeted goat grazing – A silvipastoral approach in oil palm plantations in north-eastern India

Abhishek Paul^{1*} and Supritam Das²

¹College of Veterinary Sciences and Animal Husbandry (CAU, Imphal), Selesih, Aizawl, Mizoram 796 014

²Krishi Vigyan Kendra (ICAR-ATARI, Zone VII, Umiam), Dhalai, Tripura 799 278

Targeted goat grazing offers an innovative and sustainable silvipastoral strategy for managing understory vegetation in oil palm plantations of north-eastern India. By utilising goats as biological weed controllers, plantation managers can reduce dependence on herbicides and mechanical clearing, thereby lowering production costs and minimising environmental impacts. Goats efficiently consume a wide range of grasses, shrubs, and broadleaved weeds while converting otherwise unutilised biomass into valuable products such as meat and manure. The integration of goats with oil palm cultivation enhances resource-use efficiency, improves nutrient recycling, and contributes to soil fertility through manure deposition. This approach also provides additional income opportunities for farmers through goat production, strengthening rural livelihoods and farm resilience. Furthermore, targeted grazing can improve plantation accessibility, reduce fire hazards associated with excessive vegetation growth, and support a more balanced agroecosystem.

Keywords: Agroecosystem, Biological weed control, Environmental sustainability, Small ruminants

TARGETED grazing is the intentional and strategic use of livestock to achieve specific vegetation and land management objectives. Unlike conventional grazing systems, which primarily focus on animal production, targeted grazing utilises ruminants such as goats as biological tools to manage weeds, invasive plants, and excessive vegetation. This approach has gained increasing attention as a sustainable and environmentally friendly alternative to conventional weed control methods.

Targeted grazing is particularly effective in landscapes where mechanical mowing, brush cutting, or herbicide application is difficult, costly, or impractical, such as steep slopes, rocky terrains, remote areas, and large rangelands. The effectiveness of targeted grazing depends on several factors, including livestock species, stocking density, grazing duration, and seasonal timing. When properly managed, livestock can suppress undesirable vegetation, promote the growth of

desirable plant species, and improve overall ecosystem health.

In addition to reducing dependence on expensive herbicides and mechanical control measures, targeted grazing contributes to biodiversity conservation, improved soil health, enhanced nutrient cycling, and wildfire risk reduction. As a result, it is increasingly recognised as an important tool for sustainable land management, ecological restoration, and climate-resilient agriculture. For successful targeted grazing, it needs to:

- Identify the objectives and expected outcomes for every management area.
- Determine which plant species are of significance in that region.
- Adjust the stocking density and species composition of the animals to meet those objectives.

Targeted grazing operations with goats

Goats are widely recognised as one of the most effective livestock species for targeted grazing because

of their exceptional browsing ability and adaptability to different environments. Unlike cattle and sheep, which primarily graze on grasses, goats prefer browsing on shrubs, woody plants, vines, and broadleaf weeds. This natural feeding behaviour enables them to effectively control invasive and undesirable vegetation that can reduce pasture productivity, increase fire hazards, and negatively affect biodiversity.

One of the unique advantages of goats is their ability to consume plant species that are often avoided by other livestock due to their thorny, fibrous, or bitter nature. They can feed on invasive shrubs, brush, and woody weeds, helping to reclaim overgrown land and improve access to pastures. Goats also strip bark from tree trunks and branches, a process known as girdling, which can interrupt the flow of nutrients within the plant and eventually kill unwanted woody vegetation. Repeated browsing of leaves further weakens plants by reducing the

photosynthesis, often leading to long-term suppression or complete elimination of brush species.

Targeted grazing with goats provides significant ecological benefits. It helps restore degraded rangelands, improves habitat quality for wildlife, enhances plant diversity, and reduces the accumulation of excess vegetation that can contribute to wildfires. Unlike chemical herbicides, goats offer an environmentally friendly and sustainable method of vegetation management without leaving harmful residues in the soil or water.

Combining the production of palm oil with livestock grazing

The integration of oil palm plantations with ruminant livestock production represents a promising silvopastoral system that can generate substantial environmental, social, and economic benefits in tropical regions. By combining oil palm cultivation with livestock grazing, smallholder farmers can diversify their income sources, improve farm productivity, and enhance their livelihoods, thereby contributing to poverty reduction and economic growth in oil palm-producing countries.

Oil palm-livestock integration also offers a practical approach to achieving several United Nations Sustainable Development Goals (SDGs), including poverty alleviation, biodiversity conservation, climate change mitigation, and the reduction of environmental pollution associated with excessive agrochemical use. Well-managed grazing animals such as cattle, buffalo, sheep, and goats can efficiently utilise understorey vegetation, improve nutrient recycling, and enhance the overall sustainability of plantation ecosystems.

The widespread adoption of this integrated system has the potential to increase agricultural productivity while strengthening ecological resilience and long-term economic sustainability. Among its many advantages, targeted grazing has emerged as an effective alternative



Targeted goat grazing in oil palm cultivation in Mizoram

to chemical weed control in oil palm plantations. By utilising livestock to manage unwanted vegetation, plantation managers can reduce herbicide use, lower production costs, and minimise environmental impacts. Although further research is needed to quantify the large-scale effects of oil palm-livestock integration on weed suppression and crop yields, targeted grazing remains a promising and sustainable weed management strategy for modern oil palm production systems.

Concern for herbicide use in oil palm plantations

In oil palm plantations, weed species like *Chromolaena odorata* and *Asystasia gangetica* are mostly managed with chemical herbicides because they compete with the palm oil crop for nutrients and water, which lowers crop productivity and health. To control weeds in oil palm plantations, chemical herbicides including glyphosate

(400 g/ha), gluphosinate-ammonium (200 g/ha), and paraquat (600 or 800 g/ha) are frequently utilised. In India, growing concerns over the environmental and health impacts of herbicide use have increased interest in sustainable weed management practices. Targeted goat grazing offers an eco-friendly alternative by controlling understory vegetation.

Potential of oil palm plantation as goat feed

Animal feed can be made from byproducts of the oil palm industry. This waste can be used as a staple and turned into raw materials for the ruminant animal feed sector, particularly for goats. The three primary byproducts produced by oil palm plants are palm kernel, mud/palm solid, and palm leaf midrib. However, feeding ingredients derived from oil palm byproducts have a low protein content, digestibility, and low palatability and high crude fibre

Table 1. Goat-grazed weed species for an oil palm plantation

Species	Family	Growth habit	Duration	Cumulative time spent on feeding by goats (min)
<i>Asystasia gangetica</i>	Acanthaceae	Forb/herb	Perennial	517
<i>Cenotheca lappacea</i>	Poaceae	Graminoid	Perennial	59.3
<i>Cyrtococum accrescens</i>	Poaceae	Graminoid	Annual	41.9
<i>Ischaemum muticum</i>	Poaceae	Graminoid	Perennial	23.5
<i>Paspalum dilatatum</i>	Poaceae	Graminoid	Perennial	0.05
<i>Paspalum conjugatum</i>	Poaceae	Graminoid	Perennial	0.01

content. Although these byproducts have low quality, they can support high growth and productivity with the use of technology to correct unbalanced nutrition.

Table 2. Chemical composition in oil palm

Nutrient	Palm fronds	Sludge	Palm kernel
Dry matter (%)	30.0	10.0	93.0
Crude protein (%)	6.5	13.25	15.40
Crude fat (%)	4.47	13.0	7.71
Fibre (%)	32.55	16.0	10.50
Ash (%)	14.43	13.90	5.18
TDN (%)	56.0	79.0	81.0

Management considerations

Stocking rate: For cattle, the ideal stocking rate is 1–3 animals/ha, which is also the acceptable stocking rate for goats.

Animal health: In grazing systems, routine parasite and disease monitoring and control are essential.

Water and mineral provision: Access to mineral licks and a sufficient supply of water are essential for the health of the grazing animals.

Species selection: Trees with high protein content, such as *Gliricidia sepium* and *Leucaena leucocephala*, can be used to increase dietary intake of goat.

Future of targeted grazing for weed management

Targeted goat grazing in mature oil palm plantations (>5 years old) has emerged as an environmentally sustainable approach for weed management. Goats effectively suppress undesirable vegetation through intensive browsing,

reducing the abundance and spread of weed species while minimising reliance on chemical herbicides. Short-duration, high-intensity grazing can further enhance weed control by limiting the growth and reproduction of unwanted plants.

The integration of livestock into oil palm production systems promotes a more sustainable farming approach by combining crop and animal production within the same land area. This practice reduces the need for synthetic herbicides and supports integrated pest and vegetation management strategies, thereby lowering production costs and minimising environmental impacts. As a result, targeted grazing is increasingly being recognized as a practical and chemical-free alternative for weed control in Southeast Asian oil palm plantations.

In addition to vegetation management, targeted grazing can contribute to biodiversity conservation and support the production of sustainable palm oil by fostering healthier and more resilient plantation ecosystems.

Incorporation of organic inputs like urine and dung

Reduced cost of chemical control

Soil health improvement due to less chemical use

Reduced use of fertiliser

Better crop management system

Advantages of oil palm-goat integration

SUMMARY

The main causes of the fodder crisis are declining land holdings, which forces farmers to switch to more cash-rich crops like fruits, vegetables, pulses, and oilseeds, and rapid agricultural mechanization, which prevents paddy and wheat straws from building up as dry fodder for ruminants. In large rangeland settings, targeted grazing is an underutilised technique that is quickly demonstrating its effectiveness in controlling weeds as well as a source of fodder for livestock. Operators who engage in targeted grazing need to understand the physiology, structure, growth patterns, and cycles of plant species' toxicity and palatability in oil palm silvopastoral systems. Overall, the adoption of goat-based silvopastoral systems represents a climate-smart, economically viable, and environmentally friendly solution for sustainable oil palm plantation management in north-eastern India.

*Corresponding author email: abhishek2011v01@gmail.com

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