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FOOD POLICY FORUM FOR CHANGE

How feebate policies could upscale organic agriculture and food self-suffiency in Bhutan

Bhutan has targeted becoming the world's **first country with an entirely organic agricultural production[1,2].**

As well as aligning with the Agenda 2030 Sustainable Development Goals (SDGs)[3], achieving 100% organic agriculture would support Bhutan's Gross National Happiness (GNH) index by **benefiting human health** and **improving ecological diversity**[4]. The goal includes Bhutan's most important cereal crop, rice, which accounts for around 22% of the country's total crop production by value[5]. Currently, Bhutan produces only about 47% of its domestic rice consumption[6], relying on imports for the rest[2]. Given rice's importance in the national diet, and supply vulnerabilities exposed during the COVID-19 pandemic and the war in Ukraine, **Bhutan's government has prioritized improving self-sufficiency in rice, with a 60% target**[6].

This raises a question:
is it possible to achieve 100% organic rice production while also improving self-sufficiency?

To identify and test policies aimed at this dual goal, we developed an integrated systems model to understand **how farmers might respond to policies aimed at incentivizing agroecology and improving rice self-sufficiency.**

Simulations with the model showed that a **feebate (fee and rebate) policy coupled with promotion and training in agroecological farming methods** could achieve this by incentivizing widespread adoption of agroecology.

The model developed for this research can readily be adapted to examine various feebates or other policies for incentivizing agroecology for other geographies and crops (See ref. [7] for a detailed description).

Key Points

1. Bhutan aspires to 100% organic agriculture
2. Bhutan also desires to improve rice self-sufficiency, by about 25%.
3. There are two basic production modes for rice in Bhutan: organic as traditionally practiced, often referred to as "organic-by-default", and conventional rice production which uses synthetic chemical inputs for fertilizer and crop protection.
4. Eliminating all chemical inputs using traditional organic practice would reduce average yields and worsen rice self-sufficiency.
5. A third option, widespread adoption of agroecology may achieve organic and self-sufficiency goals.
6. Perceived costs and risks may prevent farmers from adopting agroecology.
7. A hybrid policy including agroecology training and promotion, combined with a feebate policy that increases the cost of conventional agriculture while decreasing the cost of agroecology may incentivize wide-scale adoption of agroecology.
8. The feebate consists of a fee or tax on chemical inputs. The funds collected from the tax are then rebated to certified agroecological farmers. Certification and monitoring are necessary to track the agroecological farmers eligible for the rebate.
9. Designing an effective rebate program will require research to obtain better estimates of production cost and yields for organic-by-default, conventional, and agroecological production modes.

Context of rice production in Bhutan

Agriculture in Bhutan is predominately "organic by default", meaning traditional methods are used with little or no application of synthetic chemicals[5]. This is the case for around 70% of the country's rice production. Rice yields from traditional methods in Bhutan are around 25% lower than those of conventional production, which uses synthetic chemicals for fertilizers and crop protection[5]. A full conversion of conventional production to traditional organic would result in a decline in both total rice production and self-sufficiency[5].

Organic by default production does not, however, utilize **agroecological methods**, which are also reducing dependence on chemical inputs but **emphasize building soil organic matter** and **nurturing ecosystem services and biodiversity to improve yields and sustainality**[8]. In contrast to organic agriculture, agroecology considers **human, social and economic aspects** along the whole value chain.

In this model-based study, however, we focus mainly on yields and sustainability aspects. Currently, only an insignificant proportion of Bhutan's rice production is agroecological[5].

Policies to attain both 100 % organic production and improved rice self-sufficiency should therefore **promote agroecology for higher-yielding organic production.**

Reference scenarios: Dominance

To examine the possibility of achieving both 100% organic production and improved rice self-sufficiency, we used the model to first run a reference scenario, in which **no new policies** are implemented (**Figure 1-A**).

In this simulation, the amount of land being cultivated using traditional organic methods gradually declines as use of conventional farming methods increases. Although conventional farming eventually eclipses traditional organic, its application then levels out as the need for more chemical application over time raises costs. **Rice self-sufficiency slowly increases, approaching 50%** but still short of the goal of 60% at year 2040. The amount of land where rice is grown using agroecological approaches remains near zero as no incentivizing policies are in place.

We then ran a scenario to test what would happen to self-sufficiency if rice production was converted to 100% traditional organic. To do this, we simulated a heavy imposition of **taxes on conventional production** from 2022 (**Figure 1-B**). A similar approach was taken in other studies[5]. This causes the area under

organic rice production to rise quickly to 100%. However, smaller yields with organic mean **rice self-sufficiency is lower** than in the reference scenario.

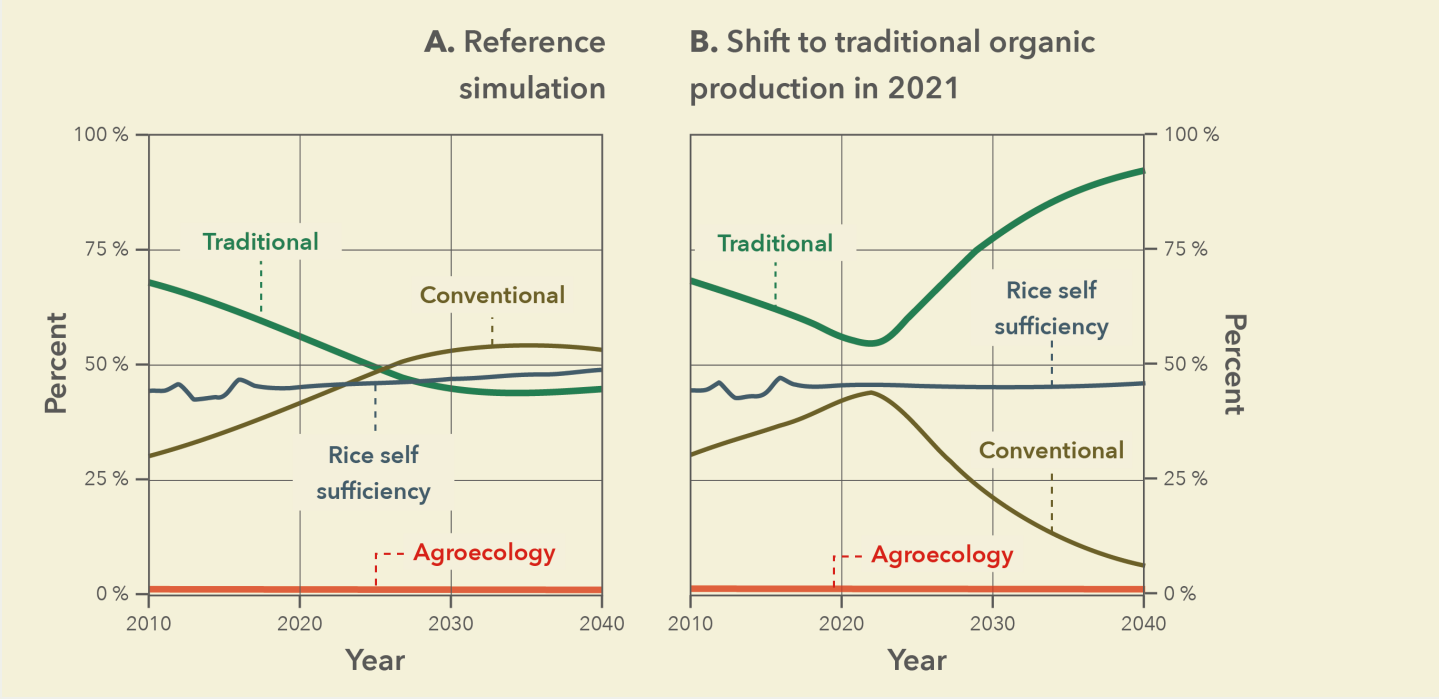

Figure 1: A. Reference scenario showing time patterns of traditional organic, conventional and agroecology rice areas, and food self-sufficiency. **B.** Impact of shifting conventional production to traditional, resulting in a strong transition toward organic but with a loss in rice self-sufficiency.

Policy scenario: Promotion of agroecology

To achieve 100% organic production and improved self-sufficiency for rice, both **traditional and conventional rice production methods must transition to agroecology**. This will require promotional activities and training.

Figure 2-A presents a scenario in which agroecological approaches are from 2021 promoted to 10% of farmers practicing traditional and conventional rice production. Farmers decide whether to adopt agroecology based on how much relative benefit they expect to derive from it. The **relative benefit for agroecology is a function of relative yield, relative price, and relative costs.**

Relative benefit for AE = (Relative yield * Relative price) / Relative cost

We assume that there is a delay between the time changes in yield, price and costs occurs and time farmers become aware of changes in the relative benefit of agroecology. The equation provides a succinct simplification of farmers' decision

making and their main drivers, namely perceived yield, value, and costs. **As more farmers adopt agroecology, peer influence becomes a dominant driver.** If farmers adopt agroecology, their cropland enters a typically three-year transitional phase, during which they **receive training** and fully adopt agroecological production methods. In the simulation, **traditional farmers adopt agroecology at a faster rate than conventional.** This is because agroecology offers a greater relative benefit over traditional cultivation than conventional agriculture. By 2040, the rice area under agroecological and under conventional production are equally dominant, each representing 43% of the total rice area.

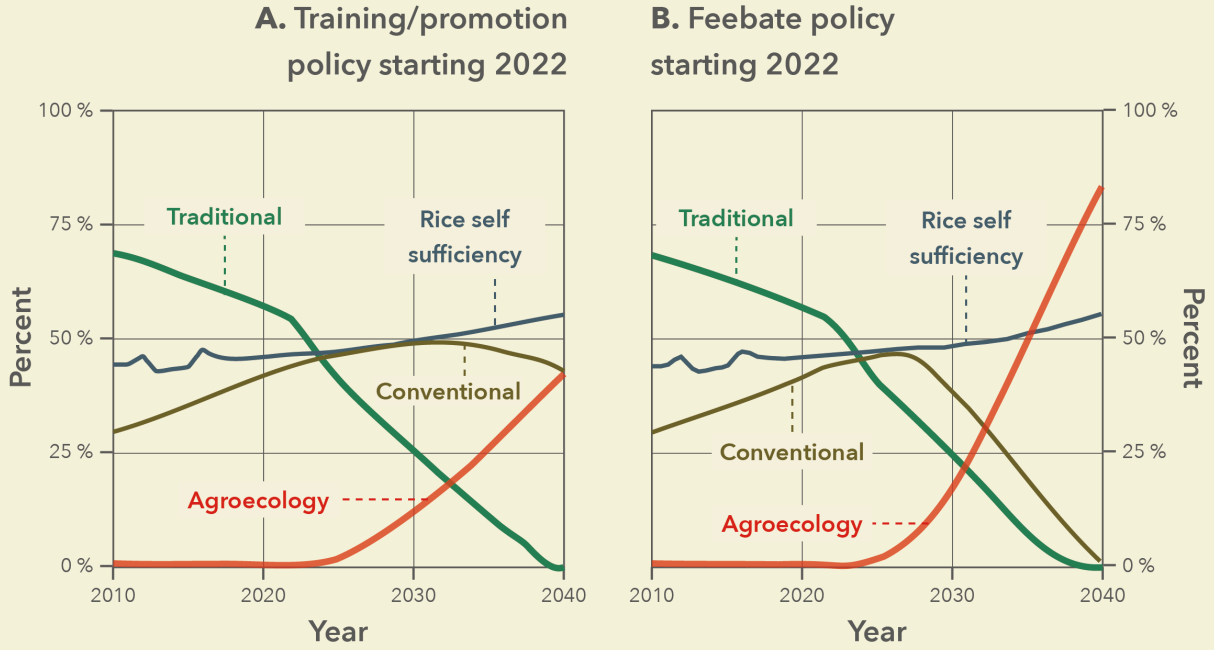

Figure 2: A. Training/promotion policy: beginning in 2022, 10 percent of farmers practicing traditional or conventional rice cultivation receive training in agroecology methods. **B.** Training/promotion plus feebate policy: beginning in 2025, the feebate policy places a gradually introduced tax (fee) on synthetic agricultural chemicals used for fertilizers and crop protection. The proceeds are distributed to trained and certified agroecological farmers.

Policy scenario: Feebate policy

By imposing fees on an undesired activity and **distributing the proceeds to those assuming a desired activity**, feebates (blend of fee and rebate) offer a self-financing and non-regulatory way of influencing change.

For a feebate to upscale agroecology, we propose a **fee (or tax) based on the synthetic chemicals used in conventional farming, with the proceeds pooled and distributed annually as rebates to farmers who are transitioning to agroecology** and are officially certified as agroecological producers. The

feebate makes conventional production more expensive for farmers and simultaneously reduces the cost of agroecology, increasing its attractiveness.

The feebate policy would be implemented and managed by a government entity. **A certification and monitoring program** is also necessary to keep track of agroecology adopters who are eligible for feebate payments. Certified farmers might potentially be able to sell their production at a premium over non-certified production if demand for such certified food products evolves in Bhutan. In this study, it is assumed that there is no premium for rice certified as agroecological.

Figure 2-B simulates the introduction in 2025 of a feebate in addition to agroecology promotion. The feebate is initiated three years after the initiation of training and promotion policy targeting farmers. The fee is set at 50% of synthetic chemical costs† and is gradually introduced over a period of three years. This allows farmers to initiate transitioning to agroecology without bearing the cost of the fee.

Under the feebate, traditional and conventional farmers adopt agroecology in response to its perceived relative benefit. By 2040, traditional and conventional rice production are near zero. **83% of the land is under agroecological production by the year 2040.** Rice self-sufficiency is just over 55% under the feebate policy at year 2040. Simulations with an extended time horizon (not shown) show that under the feebate scenario 100% agroecology in rice production would be reached at about year 2050 and 60% self-sufficiency in rice would be reached at about year 2060. However, it is important to note that the purpose of these simulations is not point prediction of agroecology area, rice self-sufficiency or any other performance variable. Rather, the simulations should be construed as experiments that reveal possible patterns of agroecology adoption and rice self-sufficiency in response to policy.

When the feebate policy is first implemented, there are many more conventional farmers than agroecological and the stock of funds from the fee on chemical inputs accumulates. As farmers shift from conventional farming to agroecology, the stock of funds diminishes until there is no longer a rebate to be paid to agroecological farmers. However, the fee on chemical inputs remains in place as a disincentive to resume conventional farming.

† A study conducted by UNEP describes taxes and fees placed on synthetic fertilizers and pesticides to incentivize farmers to practice in a more sustainable way. The study reports that: "Finland, Sweden and Austria introduced taxes on fertilizers as early as 1976, 1985 and 1986 respectively, with rates of taxation varying from 10% to 72% of the fertilizer price." In some cases, Denmark for instance, organic farmers were entitled to certain benefits from taxation, however no mention of feebate was made in the report[9].

Uncertainties and limitations

We analyzed how sensitive different policies were to uncertainties and variabilities such as potential changes over time in production costs and yield. This revealed the **feebate policy, when coupled with promotion and training programs, to be more robust** against such uncertainties and variabilities than promotion and training alone in terms of shifting rice production from conventional to agroecological. Improving understanding of variables such as relative costs and yields would enable policy makers to more effectively set the size of any feebate.

The study also has a number of limitations that point to future research opportunities. For example, it only considers rice production, and **does not include the impacts of climate change.** The model could additionally be applied to other agricultural products and locations, and used to assess other policies for upscaling agroecology, such as **encouraging consumer demand** for organic or agroecological food products.

Conclusion

For Bhutan to achieve its twin goal of 100% organic agriculture and improved food self-sufficiency, both conventional and traditional organic production systems must **transition to agroecological methods** that close the yield gap between conventional and traditional farming.

Promotion coupled with training programs may not be adequate to entice farmers to adopt agroecology at scale if risk-averse farmers perceive that shifting to agroecology may bring lower benefits in terms of income and food security.

Simulations conducted with our model show that a **feebate program that raises the cost of chemical inputs** used in conventional farming and **compensates farmers who adopt agroecological methods** could be effective at upscaling adoption of agroecological farming. This would be coupled with **promotion and training in agroecology, certification and long-term monitoring.** Although novel in agricultural systems, feebate policies offer an opportunity for a smoother transition to organic practices than bans on synthetic chemical inputs, which could disrupt production and farmer income, as seen in Sikkim[10] and Sri Lanka[11].

We, therefore, propose that policy makers consider introducing feebates for crops like rice that are currently partly produced with conventional chemical methods.

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