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SUSTAINABLE CROP RESIDUE MANAGEMENT IN GROUNDNUT: TURNING WASTE INTO WEALTH

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Abstract:
After the groundnut harvest, every field and every shelling yard is left with a mountain of haulm and shells. For many farmers this is just waste to be burnt, dumped or ignored. This article shows that it is in fact a hidden asset. India produces nearly 500 million tonnes of crop residue every year, and burning it can send up to 80 per cent of the nitrogen and 25 per cent of the phosphorus held in the residue into the air. Groundnut haulm is a valued fodder, with a mean yield of about 4.3 tonnes per hectare in one study and crude protein of up to about 13 per cent. Groundnut shells, which make up roughly 30 to 42 per cent of the pod weight, can be turned into shell manure, compost or biochar. Trials in India reported 12 to 16 per cent higher groundnut yield with shell manure and compost, while biochar at 4 tonnes per hectare along with the full fertiliser dose gave better soil conditions and pod yield on a red sandy loam. In acidic soils like those of Odisha, biochar can also help to correct soil reaction, though the dose must be measured because too much can backfire. The article presents a few simple waste to wealth ideas, links residue management with Sustainable Development Goal 2 on zero hunger and sustainable agriculture, and closes with a plan that groundnut farmers of Odisha can follow.

Keywords: Groundnut, crop residue, haulm, shell, biochar, waste to wealth, SDG 2, Odisha

INTRODUCTION

Walk through any groundnut growing village in Odisha after harvest and you will see the same scene. Heaps of dry haulm stand near the cattle shed, mounds of empty shells lie around the shelling yard, and somewhere a thin line of smoke rises from a field where the leftovers are being burnt. To most of us this looks like rubbish. To a soil scientist it looks like money being set on fire.

Groundnut is the leading oilseed of Odisha. In a three year study at Chiplima, it covered 30.5 per cent of the oilseed area of the state and gave 64.4 per cent of the oilseed production (Dash et al., 2013), and it often follows rice in the rabi season (Giri et al., 2025). Every hectare of this crop leaves behind a large quantity of biomass. What we do with it decides whether our soils grow stronger or weaker with each passing year.

India produces nearly 500 million tonnes of crop residue every year, and burning in the field remains common (Hareesh & Sridhar, 2025). This article looks at groundnut residues in a simple way: what they are, why burning is a poor bargain, and how haulm and shells can be turned into fodder, manure, biochar and income. It also shows how this small change in the field connects with the large promise of Sustainable Development Goal 2, which speaks of zero hunger and sustainable agriculture.

WHAT GROUNDNUT LEAVES BEHIND

Groundnut leaves behind three kinds of residue. The first is haulm, the dry tops and vines that remain after the pods are plucked. The second is shell, the husk that is left when pods are broken open for kernels. The third is the roots, nodules and fallen leaves that stay in the soil. Each of them has a different best use.

The quantity is not small. In a study of 47 groundnut genotypes at Thanjavur in Tamil Nadu, the mean haulm yield was 4.3 tonnes per hectare, ranging from 2.71 to as high as 7.82 tonnes per hectare (Sakila et al., 2024). The same study recorded shelling percentage between 58 and 70, which means that 30 to 42 per cent of the pod weight ends up as shell. Put simply, a farmer who harvests 2 tonnes of pods is also left with roughly 600 to 840 kg of shell, besides several tonnes of haulm.

WHY BURNING IS A BAD BARGAIN

Burning is quick, free and needs no labour, which is why farmers choose it. But the price is paid later. Burning residue can volatilise up to 80 per cent of the nitrogen and 25 per cent of the phosphorus held in it, and it adds fine particles to the air and slowly spoils soil quality (Hareesh & Sridhar, 2025). Groundnut is a legume that fixes its own nitrogen, and it would be sad to throw the gain into the sky.

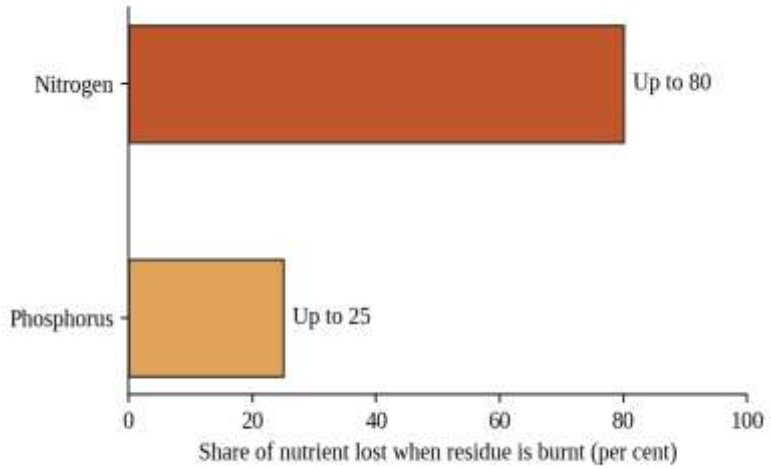


Fig: Upper limits of nitrogen and phosphorus lost when crop residue is burnt (drawn from the figures reported by Hareesh and Sridhar, 2025)

The national picture is worrying too. An inventory estimated that India generated 620 million tonnes of residue in 2008 to 2009, of which about 15.9 per cent was burnt on the farm (Jain et al., 2014). A later estimate put residue generation at 488 million tonnes in 2017, with about 24 per cent burnt in the fields (Ravindra et al., 2019). Residue burning releases greenhouse gases and particulate matter that threaten human health (Jain et al., 2014).

Odisha soils can ill afford such losses. Red and laterite soils of Mayurbhanj were acidic with pH between 4.72 and 5.84 (Sarangi et al., 2016), and the soil of the Chiplima research farm was an acidic sandy loam with low organic carbon (Dash et al., 2013). Soils like these need every bit of organic matter we can return to them. The Government of India released the National Policy for Management of Crop Residues in 2014 and has advised the states to reduce burning (Ministry of Agriculture, 2014).

HAULM: THE FODDER THAT PAYS

Haulm is the most valuable residue of groundnut, and the cattle know it. In Ananthapur district of Andhra Pradesh, groundnut haulms provided more than 70 per cent of the dry fodder, and farmers asked for residues from varieties that were free of disease and gave better quality fodder (ICRISAT, 2006).

Quality differs from variety to variety. Across 860 groundnut cultivars and breeding lines, haulm nitrogen ranged from 1.2 to 2.3 per cent, in vitro digestibility from 51.7 to 61.1 per cent and metabolisable energy from 6.9 to 8.8 megajoules per kg, and none of these traits moved against pod yield (Nigam & Blümmel, 2010). In the Tamil Nadu study, crude protein of haulm ranged from 7.83 to 13.32 per cent, and the best genotype combined a pod yield of 3.17 tonnes per hectare with a haulm yield of 7.82 tonnes per hectare (Sakila et al., 2024). The message for Odisha is clear. Choose dual purpose varieties and protect the crop from leaf diseases, because a healthy crop gives both better pods and better fodder. Handle haulm with care after harvest. Dry it well in the sun, stack it on a raised base or under cover so that it does not rot or turn mouldy, and sell or store it before the lean summer months. Haulm that is surplus to your own cattle can be sold to neighbouring dairy farmers or composted.

SHELLS, BIOCHAR AND COMPOST: FEEDING THE SOIL

Shell manure and compost

In rainfed fields of Mahbubnagar district in Andhra Pradesh, farmers used groundnut shells as bedding in cattle sheds and turned them into shell manure. Over two rainy seasons, shell manure and compost gave 12 to 16 per cent higher groundnut yield and 9 to 14 per cent higher castor yield than the farmers' practice, and in a deficit rainfall year they raised soil moisture by 14 to 40 per cent (Maruthi et al., 2008). In both years, these treatments also did better than the recommended dose of fertiliser. It is a simple and low cost idea that any farmer with a cattle shed can copy.

Biochar from shells

Biochar is a stable, carbon rich material made by slow heating of biomass with very little air, and groundnut shell is a good raw material. In a pot study in Zambia on an acid soil, groundnut shell biochar raised soil pH from 5 to 7.15 and cation exchange capacity by 75 per cent. Groundnut dry matter rose by 28 per cent at 1 and 2 per cent biochar by soil weight, but 4 per cent biochar cut water use efficiency by 45 per cent (Ngulube et al., 2018). So more is not better here either.

In a field trial on red sandy loam in north coastal Andhra Pradesh, biochar at 4 tonnes per hectare with the full fertiliser dose, or at 6 tonnes per hectare with three fourths of the fertiliser dose, gave a better soil physical environment and higher pod yield, and the highest pod yield was 4020 kg per hectare (Gurumurthy & Gowthami, 2019). In north Queensland, 10 tonnes of biochar per hectare raised peanut seed yield by 23 per cent, soil organic carbon from 0.93 to 1.25 per cent and soil water content from 18 to over 23 per cent (Agegnehu et al., 2015).

For the acidic red and laterite soils of Odisha this is promising, but these results come from other places and partly from pot studies, so local trials must guide the dose. Biochar must also be made by controlled slow burning in a closed kiln or drum and not on an open fire, otherwise it becomes just another smoky burn.

Biochar and compost together

Biochar works even better in company. In north Queensland, biochar composted together with compost at 25 tonnes per hectare raised peanut seed yield by 24 per cent, and all the organic treatments reduced nitrous oxide emission compared with fertiliser alone (Agegnehu et al., 2015). Mixing shell biochar into a compost heap of haulm leftovers and cow dung is therefore a smart way to use what the farm already has.

WASTE TO WEALTH

The first point is fodder. Selling haulm turns residue into cash, and a project in the Deccan Plateau aimed to raise the income of dairy producers from the sale of crop residues and livestock products (ICRISAT, 2006). The second point is manure. Shells used as cattle bedding and then returned to the field as shell manure can match or beat the recommended fertiliser dose in trials (Maruthi et al., 2008), which means money saved on purchased inputs.

The third point is biochar and compost, which lock carbon in the soil, hold more water and improve the response of the crop (Agegnehu et al., 2015; Gurumurthy & Gowthami, 2019). The fourth point is energy and industry. Crop residues can feed pulp, briquette, bio brick and bioelectricity units, and can also be used for mushroom cultivation and animal bedding, which brings residue into a circular bioeconomy (Hareesh & Sridhar, 2025). One estimate suggests that residue from all crops in India could generate about 120 terawatt hours of electricity, nearly 10 per cent of the total energy production of the country (Ravindra et al., 2019).

The fifth point is organisation. A single farmer may not run a kiln or a briquette unit, but a farmer producer organisation or a self help group can collect shells from local shelling yards, make compost and biochar, and sell them to neighbours. This needs collection, storage and transport arrangements, and the trade is seasonal, so it should start small and grow with experience.

HOW THIS CONNECTS WITH SDG 2

Sustainable Development Goal 2 aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. Its target 2.4 calls for sustainable food production systems and resilient agricultural practices that help maintain ecosystems, strengthen the capacity to adapt to climate change and drought, and progressively improve land and soil quality (United Nations, 2015). Residue management speaks to each of these words.

Soil quality improves when shells and haulm return as manure, compost and biochar, as the rise in soil organic carbon and soil water content shows (Agegnehu et al., 2015). Resilience to dry spells improves when soil holds more moisture, as seen in the deficit rainfall year in Andhra Pradesh (Maruthi et al., 2008). Nutrition and livelihoods improve when a groundnut crop gives both food and fodder, because dairy income and kernel protein and oil reach the same household. Climate benefits follow when fires are avoided and nitrogen stays in the soil instead of the air (Hareesh & Sridhar, 2025). The same practice also supports Sustainable Development Goal 12, which asks us to reduce waste through prevention, reduction, recycling and reuse (United Nations, 2015).

A SIMPLE RESIDUE PLAN FOR GROUNDNUT FARMERS

Let us put it all together. First, decide before harvest where every part of the residue will go, so that no one reaches for a matchbox in a hurry. Second, dry the haulm well, stack it off the ground and use it as fodder or sell the surplus. Third, collect the shells at the shelling yard and use them as cattle bedding to make shell manure, or compost them with cow dung and keep the heap moist and turned. Fourth, if a closed kiln or drum is available through your Krishi Vigyan Kendra or farmer group, make biochar from shells and try it on a small plot first, mixing it into the soil before sowing along with compost. Fifth, keep roots and nodules in the soil and do not burn the stubble. Sixth, note down your costs, yield and income, and share the result with your neighbours. Finally, ask your Krishi Vigyan Kendra or agricultural university for the doses that suit your soil.

CONCLUSION

The groundnut plant gives much more than pods. Its haulm feeds our cattle, its shells can feed our soil, and its leftovers can create small businesses in our villages. Burning throws away nutrients, pollutes the air and robs acidic soils of the organic matter they badly need. Trials show that shell manure, compost and biochar can raise yield, hold more water and cut emissions, provided the dose is right and local advice is followed. When a farmer in Odisha stops burning and starts using residues, three goals are served at once: a richer field, a bigger income and a step towards zero hunger. Waste is only wealth in the wrong place.

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