

Improving the Status of Sunn hemp as a Cover Crop for Soil Health and Pest Management

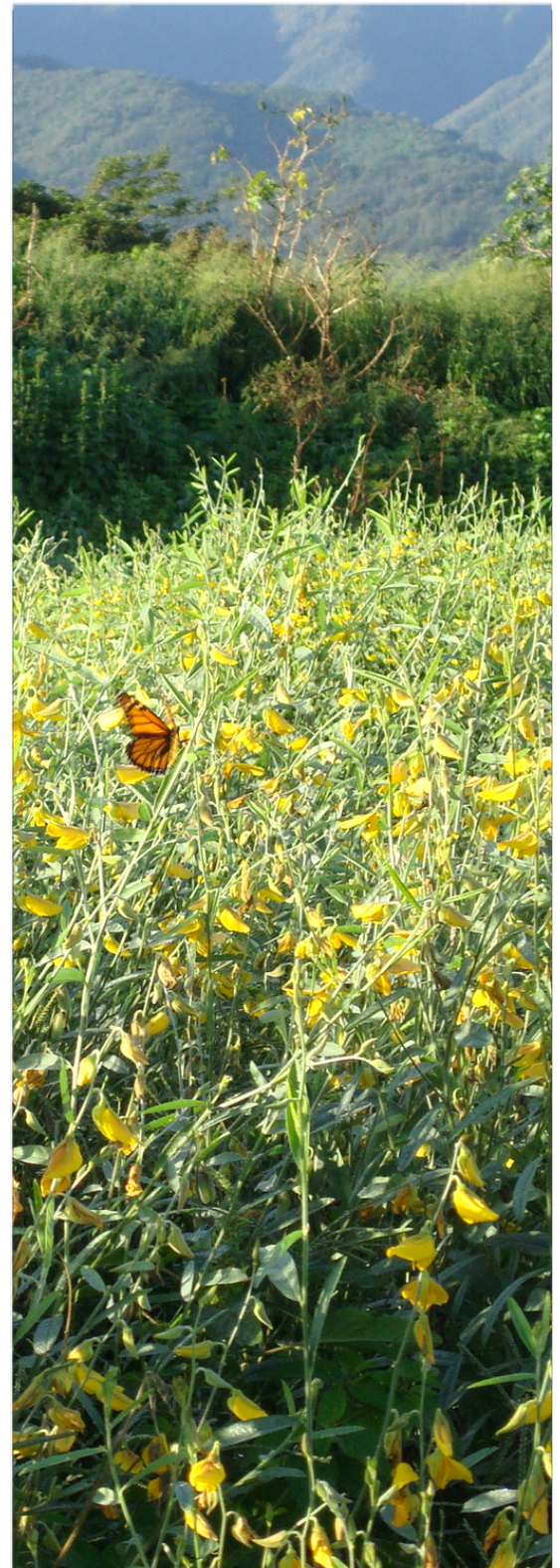
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Sunn hemp (*Crotalaria juncea*) is a leguminous cover crop adapted to tropical or subtropical area that generates much biomass (7 t/ha of air-dried organic matter at 2 months of growth), and produces 150 to 165 kg/ha of N under favorable conditions (Rotar and Joy, 1983). In addition, sunn hemp leaf extract is shown to have nematostatic effect against reniform nematode (*Rotylenchulus reniformis*) (Wang et al., 2001), burrowing nematode (*Radopholus similis*) (Jasy and Koshy, 1994), and root-knot nematode (*Meloidogyne* spp.) (Fassuliotis and Skucas, 1969; Jourand, 2004). When incorporated into the soil, sunn hemp amendments also enhance the abundance of free-living nematodes that play important roles in nutrient cycling (Wang et al., 2004), and result in higher soil nutrient content, organic matter, and cation exchange capacity, especially in soils low in organic matter (Marshall, 2002). In whole plant form, 2- to 3-month old sunn hemp has a relatively low C:N ratio (18.9:1) with N-P₂O₅-K₂O in a ratio of approximately 3:1:2 (Marshall, 2002). Under favorable soil conditions, sunn hemp could be an adequate fertilizer to meet most of the N, P, K nutrient requirements for many vegetable crops. Since most of the N and other macronutrients are found in leaves and flower heads, use of sunn hemp as a mulch or green manure would be most beneficial at the early- to mid-flowering stages (Marshall, 2002).

However, there are several limitations of using sunn hemp in a conventional cover cropping system. In a conventional cover cropping system, sunn hemp residue is incorporated into the soil after a certain period of growth as a cover crop. This article summarizes these limitations and provides suggestions on ways to improve the use of sunn hemp as a cover crop for soil health and nematode management.

Nutrients are in organic form

Although sunn hemp residues contain high amounts of N (163 lb/acre) at 2 months of growth, the majority of this N is in organic form (157 lb/acre), slowing its availability for plant to uptake (Wang et al., in press). Thus, it requires a healthy soil ecosystem to recycle the nutrients out from its organic form. A healthy soil is a soil that is capable of supporting essential life properties such as plant anchorage



and nutrient cycling, chemical and physical soil processes, soil biodiversity, and even pest suppression. Under poor soil health condition (e.g. soil that had been fallow for some time), amending soil with sunn hemp might result in a nutrient starvation condition as bacteria and fungi only release (mineralize) a small portion of nitrogen (N) into the soil while immobilizing most N in microbial biomass. Thus, crops grown after a first cycle of sunn hemp cover cropping might seem nutrient deficient. However, the mesofauna (nematodes, arthropods etc.) that feed on bacteria and fungi can excrete nitrogen-rich waste, contributing up to 30% of mineralized N and increasing plant uptake of N as much as 50% (Laakso et al., 2000). Plants rely on all trophic groups within the soil food web for nutrient mineralization. Continued planting of cover crops will maintain the integrity of a soil food web and thus sustain soil and associated plant health.

Rapid decomposition of sunn hemp residues

Sunn hemp organic matter breaks down within a short period of time (approximately 2 weeks) in a tropical climate (Wang et al., 2004), indicating that the peak N mineralization rate also would be expected around this time period. Therefore, growers could time planting and fertilizer application so that the crop will be ready to take up the nutrients within 2 weeks after sunn hemp residues are incorporated. Alternately, sunn hemp residues could be left on the soil surface as organic mulch that will decompose at a much slower rate (Reeves, 1996) but over a longer period of time. Using sunn hemp in a strip-till cover cropping system followed by clipping living mulch as surface mulch could allow partial residues to be soil incorporated and release nutrients promptly while keeping the other portion on the soil surface as surface mulch that will release its nutrients over a longer period of time.

Sunn hemp as a green manure could not suppress weeds

Several cover crops produce allelopathic compounds against weeds but sunn hemp does not possess this property. When sunn hemp is soil incorporated as a green manure, it will not suppress weeds in the subsequent crop. However, clippings of sunn hemp as surface mulch could maintain a layer of organic mulch for weed suppression pending on the amount of biomass it generates (Wang et al. 2008). To achieve sufficient weed suppression, 3 tons/acre of dry biomass need to be generated for surface mulch.

Variation of sunn hemp biomass based on planting date, soil pH and seeding rate.

Sunn hemp is a short-day facultative plant, thus day length will affect sunn hemp biomass production. Based on biomass collected at 2 months after planting (Fig. 1), we found that SH biomass accumulation varies by month of planting and soil pH but not so much by seeding rates. This is not surprising as it is known that sunn hemp tends to branch out more side shoots if plant densities are low. Thus, farmers could reduce seeding rates of sunn hemp. However, it is critical to plant sunn hemp at soil pH > 6 as it does not grow well in acidic soil. To achieve sufficient weed suppression, 3 tons/acre of dry biomass needs to be generated for surface mulch. Thus, sunn hemp should be planted between May and August to achieve this biomass. More trials need to be conducted between July to September in fields with soil pH > 6.

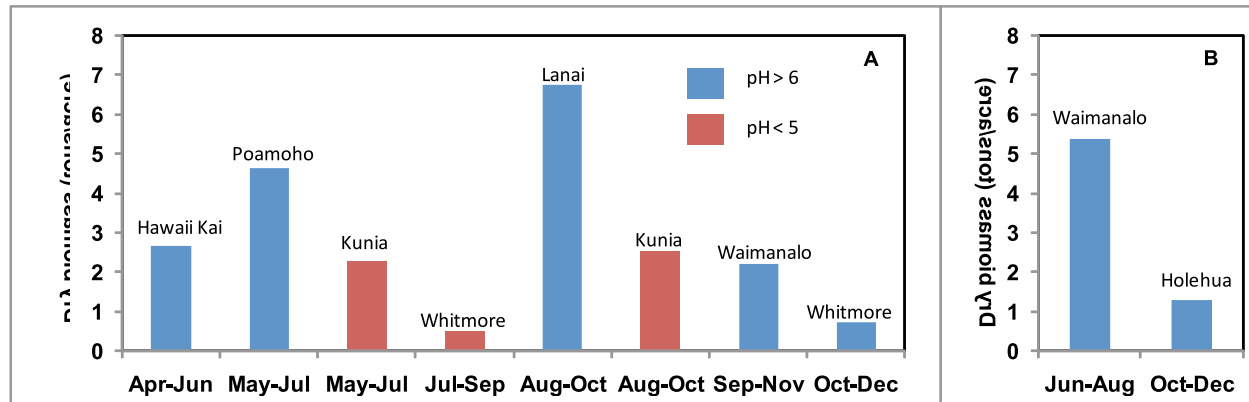


Fig. 1. Sunn hemp dry biomass accumulated at 2 months after planting from a series of farms located on Oahu and Molokai. Name of places are labeled on top of each bar. Sunn hemp was seeded at A) 30 lb seeds/acre, or B) 60 lb seeds/acre. Soil pH in most of the fields are > 6 except for fields in Kunia and Whitmore with pH < 5.

Through the better understanding of sunn hemp, use of sunn hemp for soil health and pest management can further be improved.

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