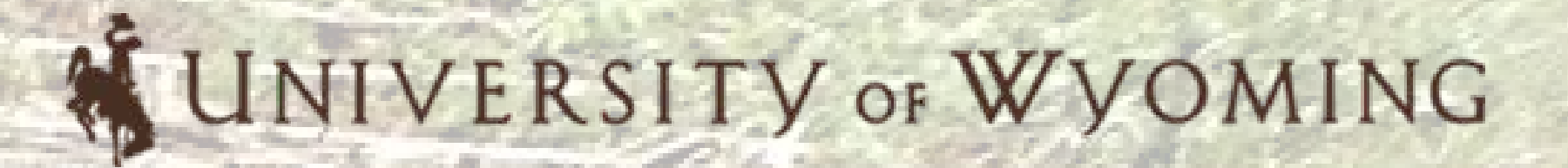


Farmer co-designed agroforestry initiative reduces field residue removal by subsistence farmers in Kenya



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Introduction

- Soil resource depletion and land degradation are key contributing factors to food insecurity in Sub-Saharan Africa (SSA).
- Emerging conservation agriculture practices (CAP) encourage smallholder farmers to leave post-harvest maize residue on the field to restore soil organic matter (SOM), soil fertility and to improve overall agroecosystem sustainability (Lal, 2010).
- Maize stover is however, a valuable resource used by farmers as indicated by active residue collection after the maize harvest and lack of surface residue during pre-plant field preparation (Neyeko et al., 2004).
- Many CAPs have begun incorporating agroforestry strategies to diversify current cropping systems. These strategies often include non-native or locally unavailable trees and shrubs (Neyeko et al., 2004) and have not yet been very successful (Kristjanson et al., 2012). Cultural practices, taboos (culturally restricted), insufficient knowledge and affordability put additional limitations on adoption and adaptation (Lal, 2010).
- Thus carefully designed participatory on-farm research is necessary to properly address tradeoffs between investing in long-term soil fertility and everyday food availability (Kanyama-Phiri et al., 2008).

Hypothesis

Post-harvest crop residue use is critical to current farmers livelihood and co-designed resource alternatives will provide successful solutions without a significant impact on their subsistence.

Objectives

1. Quantify the magnitude and sources of plant biomass used by a household
2. Determine the magnitude and purpose of post harvest residue
3. Assess the effectiveness and timing of the transition to alternative biomass sources

Materials and Methods

Location:

Nalonda District, Kenya

Growing season: biannual

Plot Logistics:

4 smallholder farms ~ 0.4 ha

Study Duration: 18 months

Agroforestry Species Selection (Five):

- *Sesbania* (*Sesbania sesbania*),
- *Lusola* (*Markhamia lutea*)
- *Calliandra* (*Calliandra Calothyris*)
- *Napier Grass* (*Pennisetum purpureum*)
- *Tithonia* (*Tithonia diversifolia*)

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Results

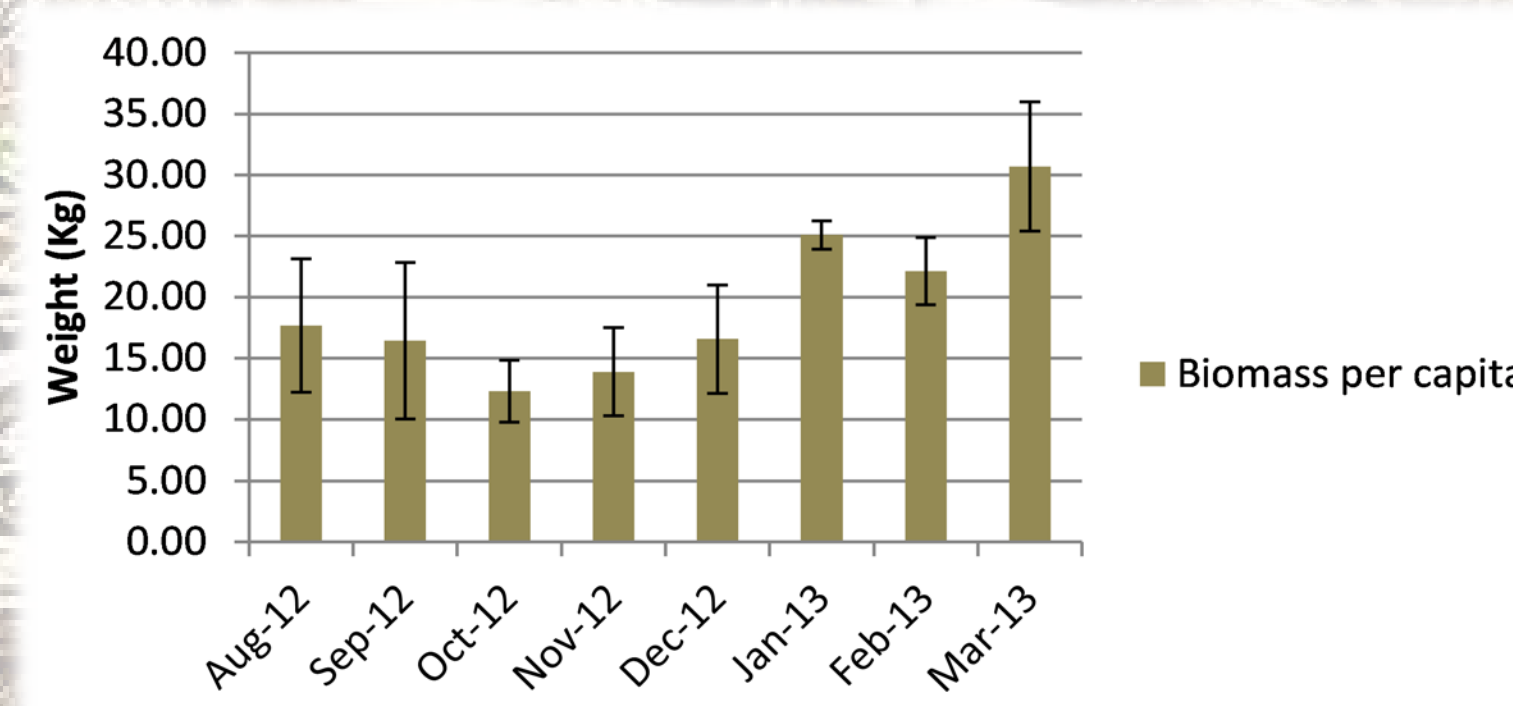


Fig. 1. Biomass per capita per month
Average of 13 members / household. Total fuel consumption per household ranges from 144 - 360 Kg / household.

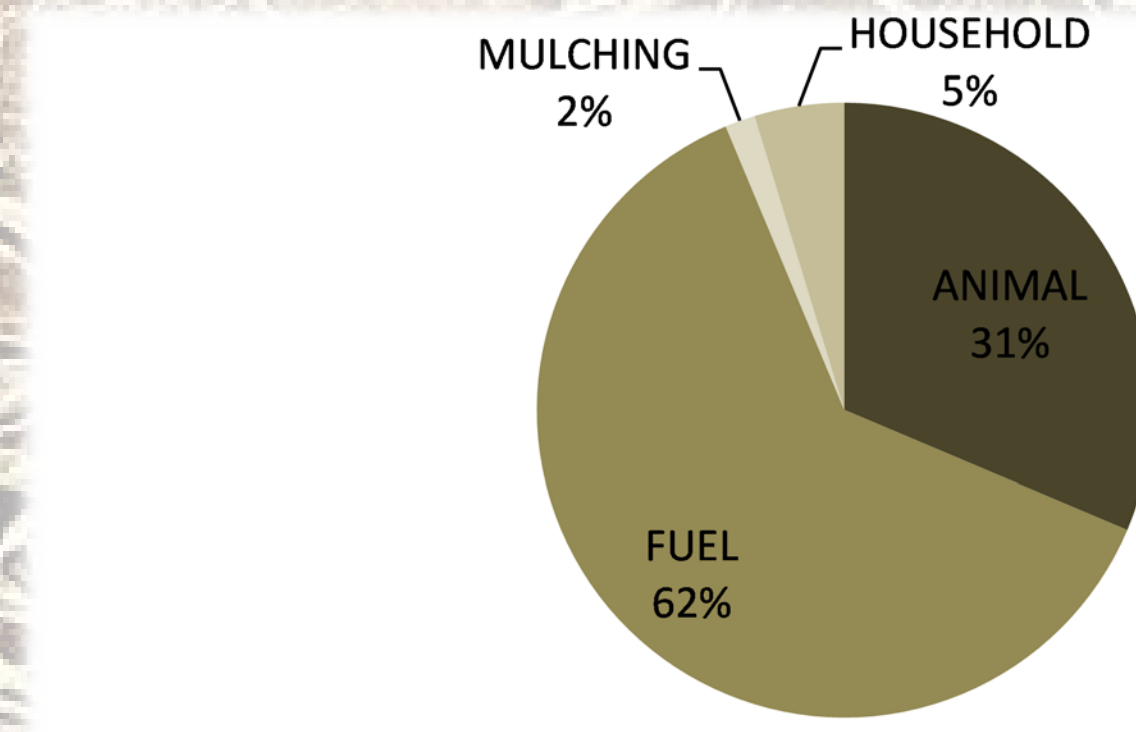


Fig. 2. Total biomass use by household
1.8 tons of total biomass used between August '12 - December '12. 31% was consumed for animal fodder. 62% was used for cooking fuel.

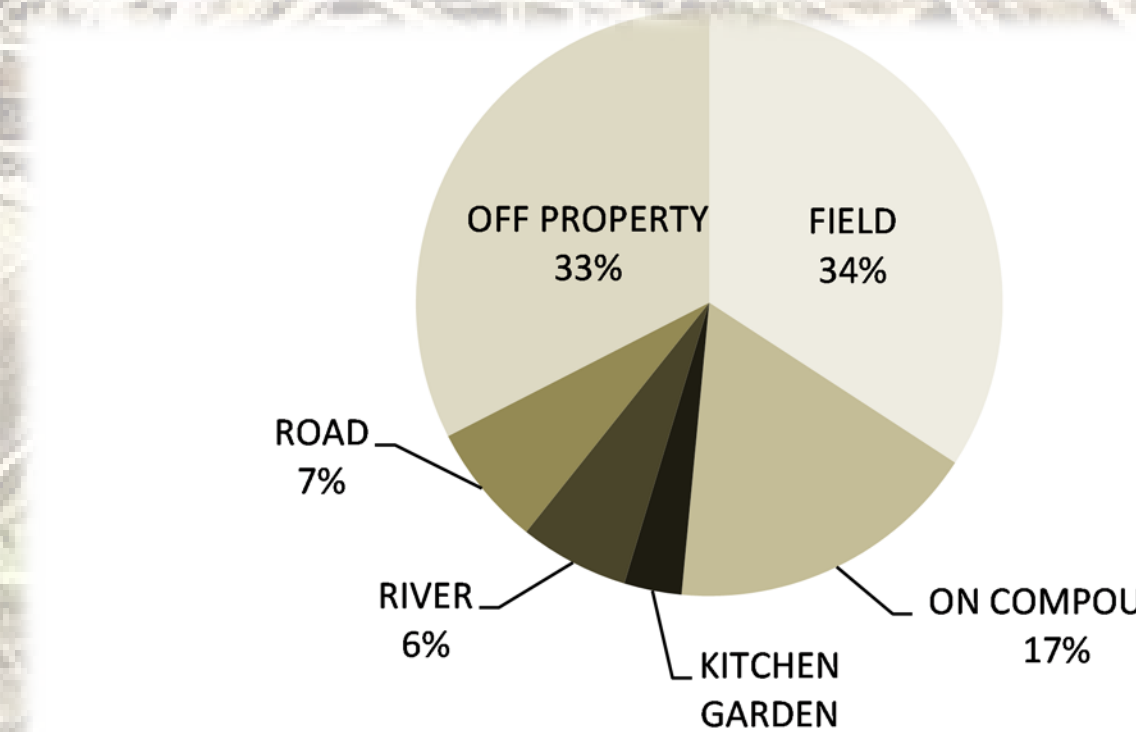


Fig. 3. Biomass procurement area
Total biomass procurement area August '12 - December '12. Majority of sources are procured off field (66%). Crop residue removed from field accounts for 34% of total plant biomass.

On average, 18 kilograms of plant biomass is used by an individual household member (family size 8-20 members) per month. The biomass is primarily used for cooking and is obtained from sources other than field. The majority of crop residues are used as animal fodder followed by mulching, cooking, and various household tasks. The greatest residue collection occurs shortly after the maize harvest, which in the bimodal climate, occurs in September and December. Crop residue removal directly correlates with residue availability associated with harvest. Of the total crop residue available for use, 75% is removed (0.6 tons) and 25% is incorporated (0.2 tons) using an inversion plow. Establishment of alternative species, *Pennisetum purpureum*, and *Tithonia diversifolia* provided over 40% of total procured plant biomass as early as February 2013 (six months after establishment) and has also become an additional source of income (data not provided).

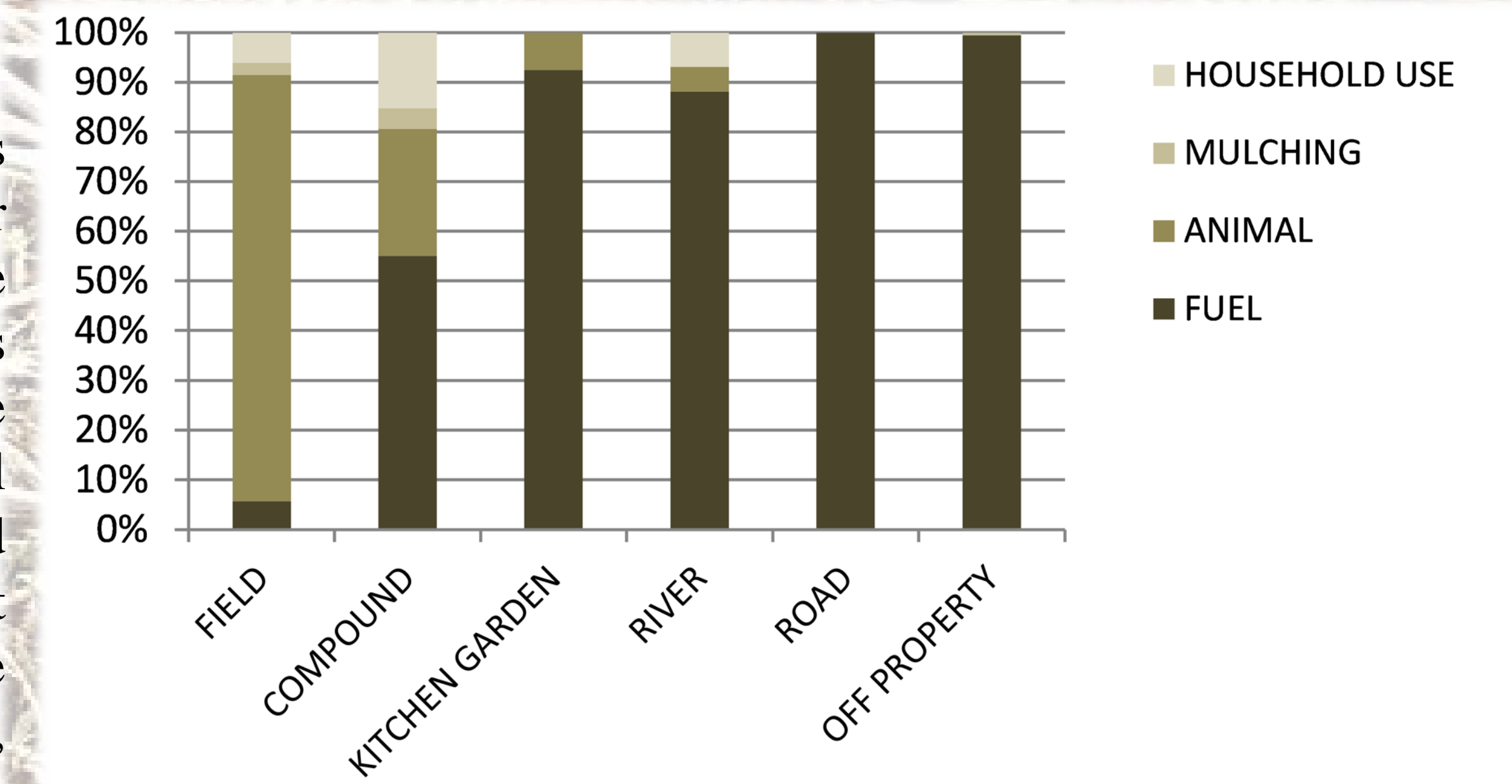


Fig. 4. Procurement strategies
86% of crop residue is used for animal fodder. Remaining residue is used for cooking fuel, mulching, and household use.

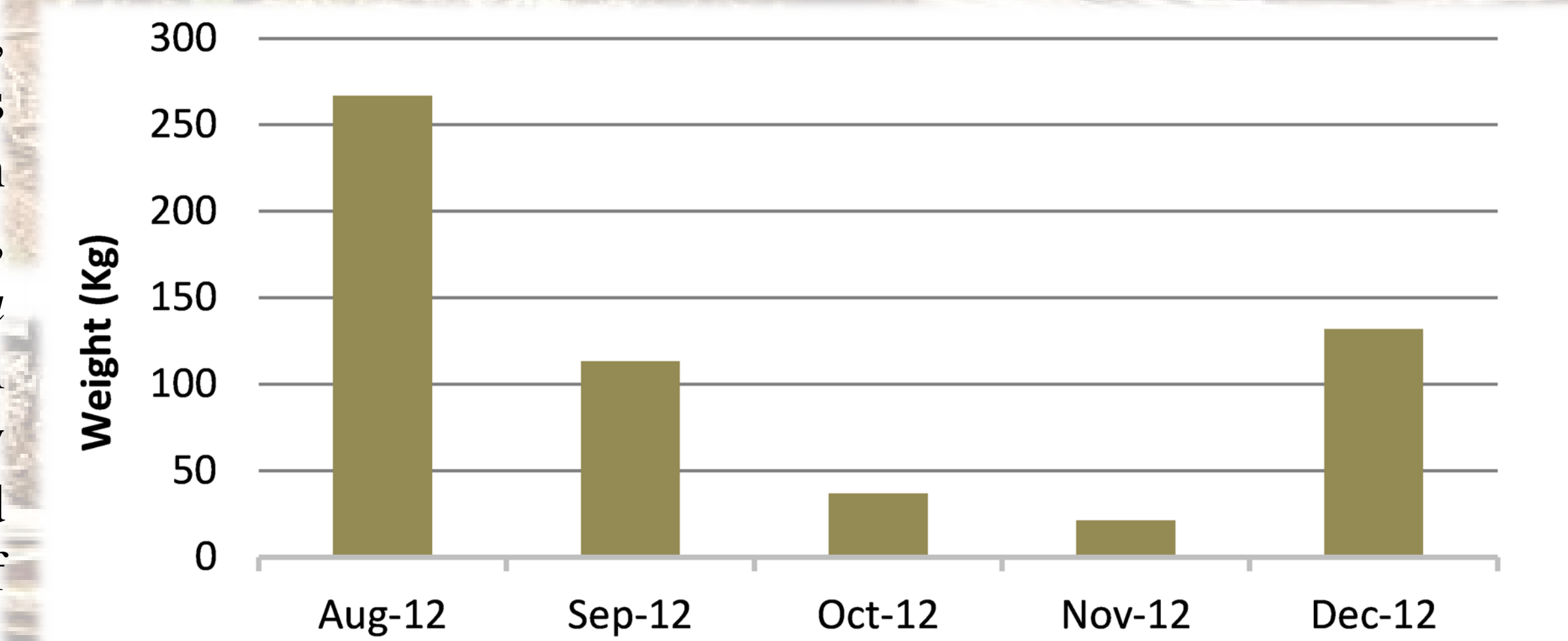


Fig. 5. Field residue removal per month [Kg / farm (0.4 hectare)]
Bimodal climate: August and December harvest. August-December 0.6 tons (75%) residue removed from field and 0.2 tons (25%) incorporated in the field. Total amount of available residue: 0.8 tons.

Conclusions

Crop residue removal in subsistence farming is significant and notably greater compared to biomass removal in developed countries (70% maximum in US and Canada). The introduction of alternative plant perennial grass species, *Pennisetum purpureum*, as suggested by farmers, provide a desirable alternative to crop residue for animal fodder. Farmer-suggested species that establish quickly and are easily adopted, are necessary to meet everyday pressures, can help alleviate the pressures of residue removal, and ensure long-term sustainability. On farm biomass utilization must be assessed prior to species identification to ensure that appropriate species are incorporated.

Acknowledgments

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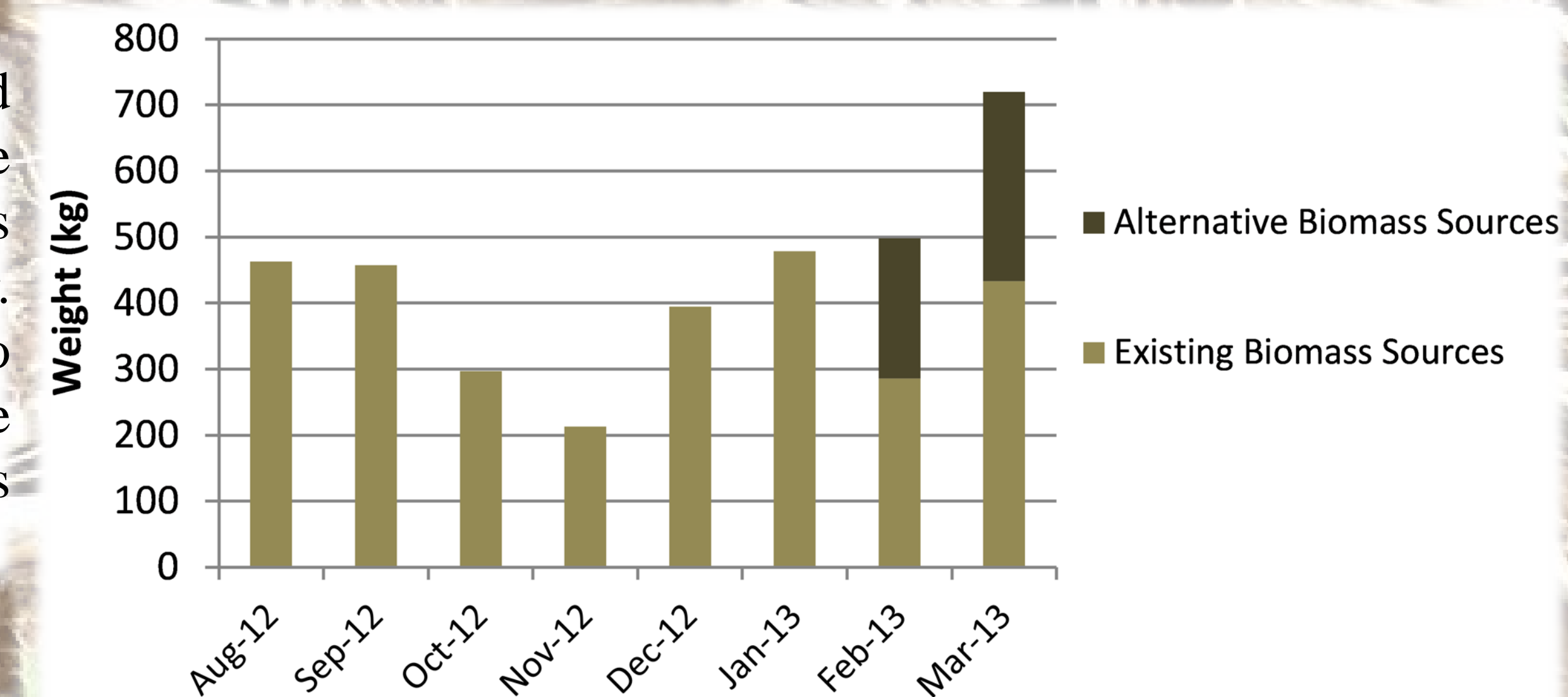


Fig. 6. Existing biomass sources : Alternative biomass sources / month
Transition to alternative use began six months after incorporation. Alternative biomass in February: 0.2 tons (43%) and alternative biomass in March: 0.3 tons (40%).

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