

# Promoting Participation in Value Chains for Pulses in Malawi

## Who and where to target

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### Introduction

In this Policy Note, we examine both household and spatial factors that may drive participation by smallholder farming households in commercial value chains for pulses, legume crops that are primarily harvested for their dry seed. Here the focus is on value chains for common bean (*Phaseolus vulgaris*), cowpea (*Vigna unguiculata*), and pigeonpea (*Cajanus cajan*). Bean and pigeonpea are particularly important secondary crops within many smallholder farming systems in Malawi, while cowpea is less common. All are commonly grown as intercrops in smallholder farming systems, primarily with maize.

By directing increasing shares of their farm production to the market and, thereby, realize greater incomes, smallholder farming households can significantly accelerate local agricultural and rural economic development. The increased income of these progressively more commercially oriented farmers increases their demand for the goods, services, and labor that can be supplied by other, often poorer, households in their community, expanding local non-farm employment opportunities and raising incomes for those other households.<sup>1</sup> Appropriately targeting agricultural development efforts towards commercially oriented farming households has important second-round economic development benefits in their communities, effects which cannot be achieved without properly identifying such households. In this paper, the potential is assessed for where and for what type of smallholder farming households pulse crops might form a significant part of their crop mix, particularly for commercial production.

All three pulses have been produced in Malawi for several generations, if not centuries. Annual production and yield levels for these crops in recent years are shown in Table 1. Based on recent spatially disaggregated production data from the Agricultural Production Estimates System of the Ministry of Agriculture and Food Security, common bean is grown primarily in the mid-altitude plateau, particularly in the Lilongwe-Kasungu plain of the Central region and in the Shire Highlands of the Southern region. Pigeonpea production is centered in the Southern region both in the mid-altitude Shire Highlands and in the lowland areas of the Upper Shire Valley and around Lake Chilwa. Long-duration pigeonpea varieties notably benefit from the light *Chiperoni* dry season rains that fall in the South but not elsewhere. Cowpea is less commonly produced overall. It is found

primarily in the Southern region, with production concentrated in the Lower Shire Valley and in districts south and southwest of Lake Chilwa.

**Table 1:** National production and yields of common bean, cowpea, and pigeonpea in Malawi, annual average for 2013/14 to 2018/19

	Common bean	Cowpea	Pigeonpea
<b>Production, mt</b>	194,000	41,000	385,000
<b>Yields, kg/ha</b>	560	440	1,570
<b>Potential yields, kg/ha</b>	2,000	2,000	2,500

**Source:** Production and actual yields based on analysis of annual data from Agricultural Production Estimates System, Ministry of Agriculture. Potential yields from Ministry of Agriculture and Food Security (MoAFS). 2012. *Guide to Agricultural Production and Natural Resources Management in Malawi*. Revised. Lilongwe: MoAFS.

Bean and cowpea are used primarily for own consumption within the household, but many farmers sell part of their harvest. Pigeonpea similarly is grown for own consumption. However, over the past 50 years pigeonpea producers in Malawi have found a reasonably strong export market for their crop in India, facilitated through resident South Asian processors in Blantyre.<sup>2</sup> Malawi has been among the major exporters of pigeonpea to India. However, in recent years India has imposed quotas on imports from Malawi, resulting in a drop in prices and considerable uncertainty in the market for pigeonpea.<sup>3</sup> Nonetheless, we find that nationally pigeonpea is the most grown of the three pulses. Smallholder farmers, if they do grow it, also tend to devote a greater share of their cropland to pigeonpea than to bean or cowpea.

In what follows, after considering the agro-ecological suitability of different areas in Malawi for production of pulses, two sets of analyses are done using household level data from the fourth Malawi Integrated Household Survey (IHS4) of 2016/17.

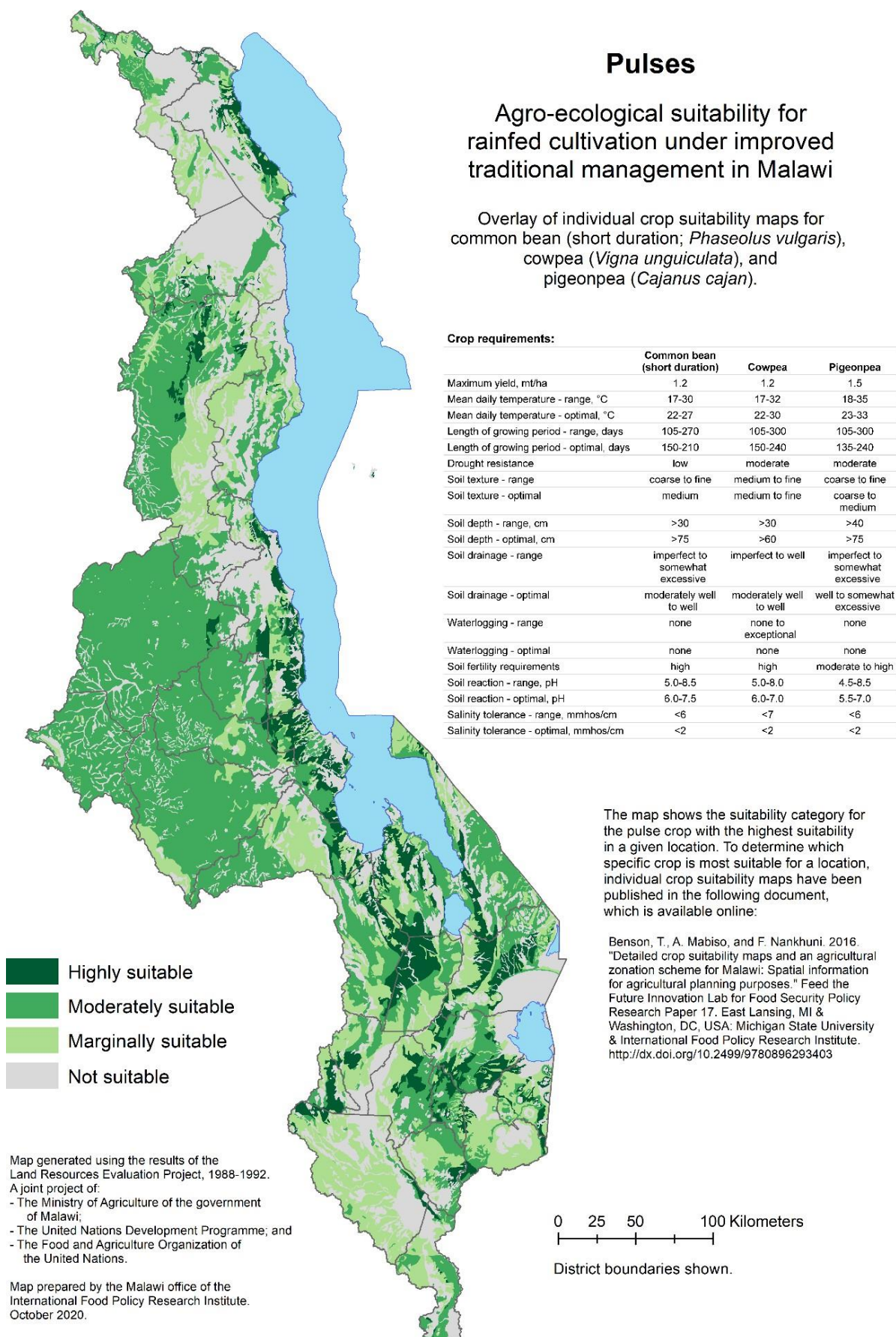
- ▷ We develop a four-category typology of Malawian households based on survey information on their economic engagement and level of crop sales. The propensity of households in each category to produce the three pulse crops, to sell any of their production, and, if they sold any, the share of production sold is then explored.
- ▷ We then examine in a multivariate context drivers of household participation in pulse value chains.

These analyses are done to generate evidence on where and which farming households might grow pulses on a commercial basis across Malawi. Government and other agricultural stakeholders can use this information to identify and foster the participation of smallholders in pulse value chains either through direct support to households that are most likely to engage in the commercial production of one of these pulses or through targeted investments in the specific pulse value chain either upstream around input supply or downstream to improve and expand the marketing and processing of the crop.

## Agro-ecological suitability for pulse production across Malawi

Figure 1 shows an overlay of crop-specific suitability maps for common bean, cowpea, and pigeonpea, with the value mapped for each land unit being the highest suitability level in a given location for any of the pulses considered.<sup>4</sup> Generally we find that these pulses are relatively well suited for production across Malawi.<sup>5</sup> The areas around Lake Chilwa and in the Lower Shire Valley that are

**Figure 1:** Crop suitability map for production of pulses – common bean, cowpea, and pigeonpea – in Malawi under improved traditional management



**Source:** Benson, Mabiso, and Nankhuni (2016).

subject to flooding and the Rift Valley escarpments in the transition zones from the mid-altitude plateau areas to the lakeshore are the principal areas where pulses are unlikely to do well.

Given the general agro-ecological suitability of most land in Malawi for production of pulses, the principal spatial constraints to smallholder farmers engaging in their commercial production are more likely to be linked to the costs producers would face in order to profitably sell their pulses.

## Which households produce pulses in Malawi?

Analysis of the nationally representative IHS4 survey data shows that about one-third of all farming households in Malawi produce bean, cowpea, or pigeonpea (Table 2). Pigeonpea is the most commonly produced pulse, with 22 percent of farming households growing the crop. Twelve percent produce bean. Only a small share of farming households produce cowpea.

**Table 2:** Production of pulses by households that produce any crops, 2016/17

	Pulses	Common bean	Cowpea	Pigeonpea
<b>Produce [crop], % of households engaged in crop agriculture</b>	34.7	12.3	2.2	22.4
<b>If produce [crop], cropped area under [crop], ha</b>	0.24	0.23	0.24	0.22
<b>... cropped area under [crop], % share of total cropped area of producers</b>	48.7	38.3	34.2	49.8
<b>Sold [crop], % of [crop] producers</b>	34.4	30.7	20.8	35.1
<b>If sold any [crop], share of [crop] harvest sold, %</b>	61.4	67.6	61.1	59.0
<b>... sold more than half of crop, % of [crop] sellers</b>	55.0	59.3	57.4	53.7

**Source:** Author's weighted analysis of 2016–17 Malawi Integrated Household Survey.

**Note:** Observations (IHS4 survey sample households that engage in crop agriculture): 9,293.

The area farmers devote to each crop if they grow it is about the same for all three crops at about one-quarter of a hectare. However, as noted, those who grow pigeonpea dedicate a considerably larger share of their cropland to the crop than do those growing bean or cowpea. This is because landholdings are smaller in southern Malawi, where almost all pigeonpea is grown. Consequently, even if the amount of land a farmer devotes to pigeonpea may be similar to that which other farmers devote to bean, for example, the share of the farmer's cropland planted to pigeonpea will be relatively greater than the share of their cropland bean producers devote to those crops. However, as all three pulses commonly are intercropped with other crops at varying intensities, these estimates of the area and share of cropland devoted to each are likely to be imprecise.

The three pulses are primarily grown for own consumption – only about one-third of those that grow them sell any of their harvest. However, there are differences between the crops – only 20 percent of cowpea producers sell any of their production, whereas around one-third of bean and pigeonpea farmers sell some of the crops. However, if a farmer sells part of their pulse crop, they report selling a substantial share of about 60 percent. More than half of pulse sellers sell more than half of the pulses they harvested.

To help understand what sorts of households produce and sell pulses in Malawi, all IHS4 survey sample households were placed into one of four categories based on their level of productivity, location, and the share of their maize production that they sold:

- ▷ **Commercially oriented smallholder households** reside in rural areas, are not ultra-poor (based on the food-based ultra-poverty line used in the poverty analysis of IHS4) and produce considerably more maize than they consume within their households. Households are categorized as commercially oriented if they reported selling annually more than 25 percent of the maize that they reported harvesting.
- ▷ **Other productive rural households** are economically active rural households that do not sell much, if any, of their maize production. The bulk of Malawian households fall into this category.
- ▷ **Not economically productive households** are ultra-poor with high dependency ratios, i.e., the share of household members that are workers (between 15 and 64 years of age) is less than 0.50 – that is, there are more members who are non-workers than workers.
- ▷ **Urban households** are economically productive households residing in urban areas. Thirty percent of such households reported engaging in some farming.

Commercially oriented smallholders are most commonly found in the mid-altitude plateau areas of the Central and Northern regions that agro-ecologically are among the best areas of the country to produce maize. Rural land pressures are not as severe in these areas as in upland areas in the Southern region contributing to greater surpluses. In contrast, commercially oriented farming households in southern Malawi are rare – a subsistence orientation to farming dominates. A larger share of not economically productive households is found in southern Malawi.<sup>6</sup>

The information on the production and sales of pulses in general that was presented in Table 2 is disaggregated by household economic category in Table 3. There is little difference between the four household categories in terms of the share of households that produce pulses in aggregate. However, with regards to sales, commercially oriented households are more likely to sell some of their pulse harvest and tend to sell a greater share of it than do pulse producing households in other categories.

However, when these estimates are disaggregated by crop, more complex patterns emerge. Pigeonpea is far less likely to be produced by commercially oriented smallholders than by either other productive rural households or those that generally are not economically productive. However, this stems to a large degree from surplus maize producing households being rare in southern Malawi, where most pigeonpea is grown. Nonetheless, the commercially oriented smallholders that do grow pigeonpea are more likely to sell part of their harvest, and a relatively larger share of it, than are households in other categories.

In contrast, bean, which is grown in all three regions, primarily in the mid-altitude plateau areas, is more likely to be grown by commercially oriented smallholders. These households are also more likely to sell part of their bean production.

**Table 3: Production of pulses by households in different economic categories, 2016/17**

Characteristic	All households	Commerci-ally oriented smallholder households	Other productive rural households	Not economically productive households	Urban households
<b>Share of households in the population, %</b>	100.0	5.5	66.6	9.2	18.7
Rural North	6.8	6.0	83.8	10.1	0.0
Rural Central	36.2	10.7	80.5	8.8	0.0
Rural South	38.0	3.1	83.6	13.3	0.0
Urban	19.0	0.0	0.0	1.7	98.3
<b>Engaged in crop agriculture, %</b>	75.8	100.0	84.7	88.9	30.3
<b>Household cropland holding, for those engaged in crop agriculture, ha</b>	0.66	1.01	0.66	0.53	0.54
<b>Pulse (common bean, cowpea, pigeonpea) producing households, of those engaged in crop agriculture, %</b>	34.7	34.7	34.8	36.3	31.1
<b>If produce pulses, cropped area under pulses, ha</b>	0.24	0.35	0.23	0.24	0.22
... cropped area under pulses, % share of total cropped area	48.7	47.3	48.0	52.3	52.4
<b>Sold pulses, % of pulse producers</b>	34.4	48.2	34.6	28.6	28.2
If sold any pulses, share of pulses sold, %	61.4	66.9	60.9	60.0	60.3
... sold more than half of crop, % of pulse sellers	55.0	58.2	54.6	51.2	59.9
<b>Common bean producing households, % of engaged in crop agriculture</b>	12.3	23.6	11.2	8.1	17.8
Sold common bean, % of bean producers	30.7	40.6	30.6	20.4	25.2
If sold any bean, share of common bean harvest sold, %	67.6	68.7	66.7	77.9	67.2
... sold more than half of crop, % of bean sellers	59.3	59.7	58.1	74.6	60.3
<b>Cowpea producing households, % of engaged in crop agriculture</b>	2.2	2.4	2.2	2.6	1.6
Sold cowpea, % of cowpea producers	20.8	30.5	19.1	25.6	19.3
If sold any cowpea, share of cowpea harvest sold, %	61.1	67.1	63.2	51.4	48.6
... sold more than half of crop, % of cowpea sellers	57.4	52.4	68.0	21.3	36.5
<b>Pigeonpea producing households, % of engaged in crop agriculture</b>	22.4	11.1	23.5	27.6	15.2
Sold pigeonpea, % of producers	35.1	59.4	35.3	29.7	28.8
If sold any pigeonpea, share of pigeonpea harvest sold, %	59.0	65.6	59.2	57.4	51.1
... sold more than half of crop, % of pigeonpea sellers	53.7	57.4	53.9	48.8	56.8
<b>Observations</b>	12,447	636	7,869	1,725	2,217

Source: Author's weighted analysis of 2016–17 Malawi Integrated Household Survey.

## Household and contextual drivers of the production and sale of pulses in Malawi

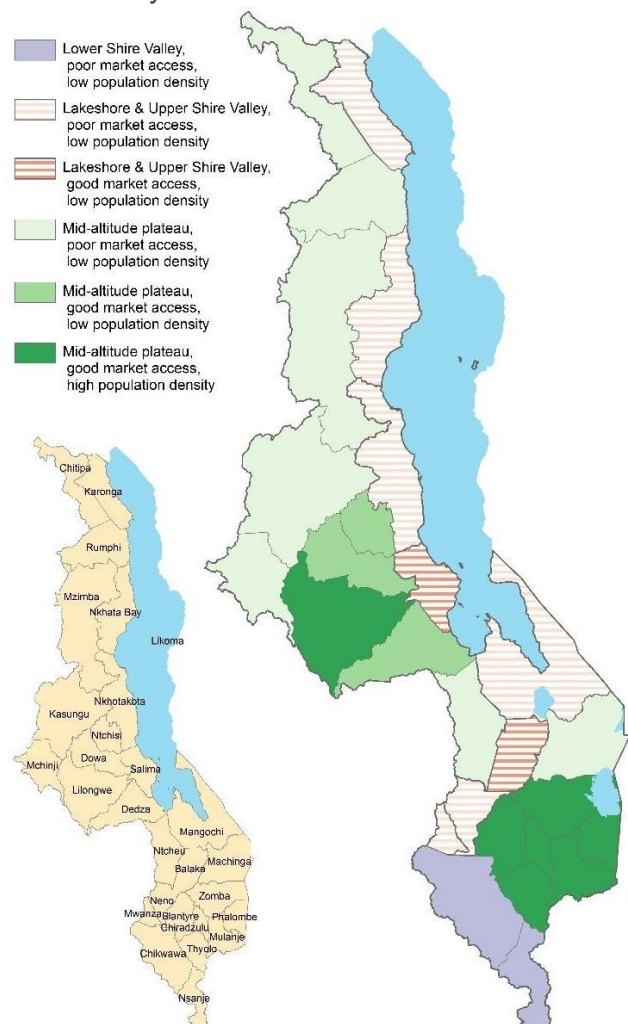
Tables 2 and 3 can only provide limited insights into the household characteristics and contextual factors that are driving the engagement of households in the production and possible sale of pulses. To gain greater insights into these factors, we undertake three logistic regression analyses:

- ▷ Using the IHS4 sample of all crop-producing households, we first examine what factors are associated with a household producing any pulse crop (bean, cowpea, or pigeonpea).
- ▷ We then examine for the sub-sample of all pulse producing households in the IHS4, what factors are associated with their selling some of their pulse production.
- ▷ Finally, for the sub-sample of households in the IHS4 that sold some of their pulse production, we analyze what factors are associated with those that sold more than half of their production.

We use the same explanatory variables in all three models.<sup>7</sup>

- ▷ **Household demographic characteristics** – household size, share of household members that are workers, whether the head is a woman, and the age of the head (less than 35 years, 35 to 64 years (base category), and 65 years or older).
- ▷ **Maximum educational attainment within the household** – no education, some primary education (base category), and secondary level or higher.
- ▷ **Agricultural production characteristics** – total cropped area for household, whether household hired-in labor, whether household hired-out any of its labor (*ganyu*), and amount of livestock owned.
- ▷ **Non-farm livelihoods, credit** – household member has wage employment, household has a non-farm economic enterprise, and member received a loan in past year.
- ▷ **Relative dependence on market for consumption** – share of maize reported consumed by the household in the past week that was purchased is used as a proxy measure.

**Figure 2: Malawi – Agricultural development domains by district**

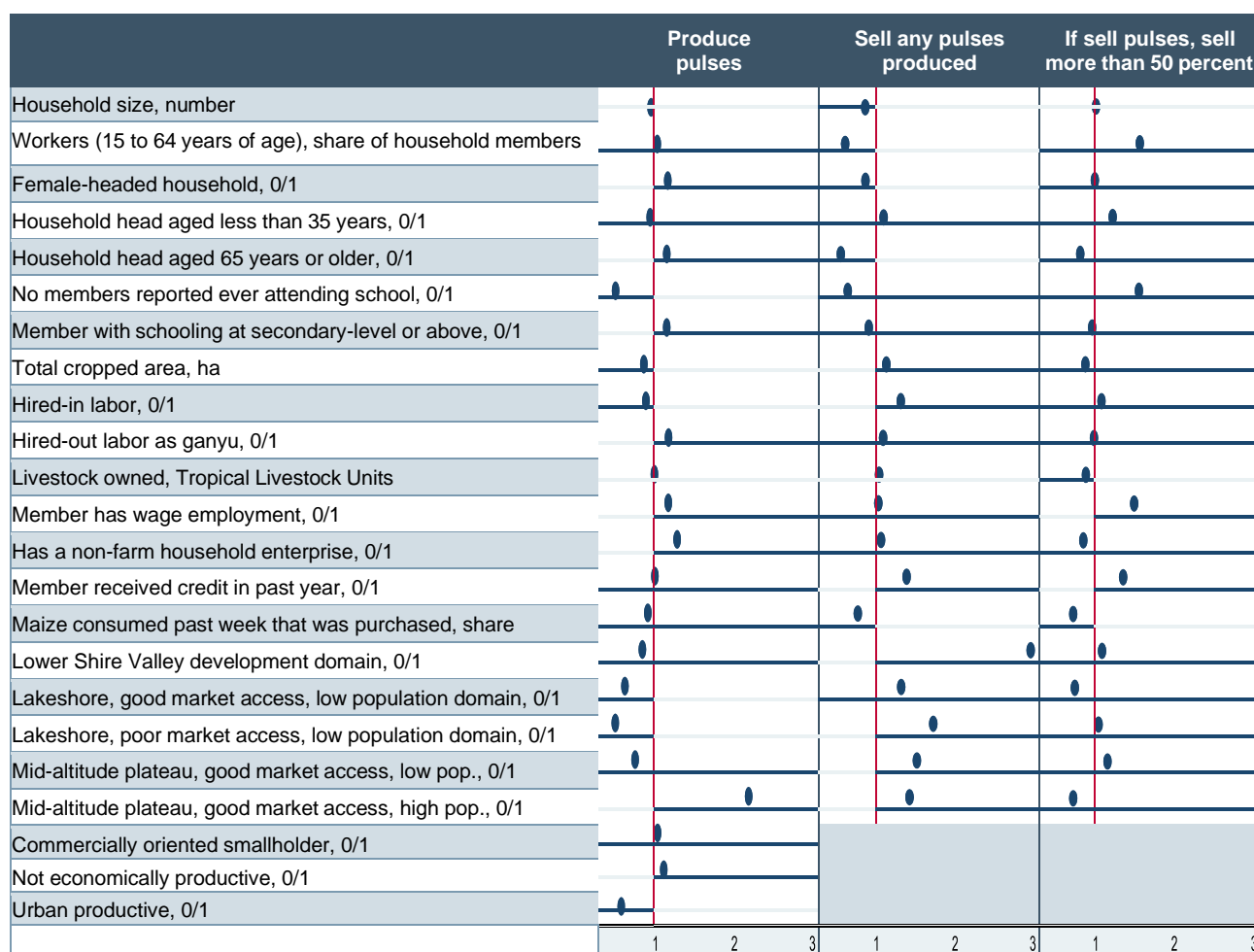


Source: Benson, Mabiso, and Nankhuni (2016).

- ▶ **Agricultural development domains** – All districts of Malawi have been assigned to one of six domains that reflect variation in agricultural commercialization potential across Malawi as defined by agro-ecological conditions, market access, and population density (Figure 2).<sup>8</sup>
- ▶ **Household economic category** – commercially oriented smallholder households, other productive rural households (base category), not economically productive households, and urban households.

The results of the three logistic analyses are presented in Figure 3 as plots of the odds-ratio for each explanatory variable together with their 95 percent confidence intervals.<sup>9</sup> Those explanatory variables for which the plot of the confidence interval of the odds-ratio does not cross the 1.0 odds-ratio line are statistically significant (at the 5 percent level) factors associated with a household engaging in pulse production, making some sales of the pulses they produce, or, if they sold any of their pulses, selling more than 50 percent of their production, respectively.

**Figure 3:** Household and contextual factors associated with pulse production and sales, results of logistic analysis, plots of odds-ratios with 95 percent confidence intervals



**Source:** Analysis of IHS4.

**Notes:** 'Produce pulses': Observations: 9,293 households; pseudo-R2: 0.062. 'Sell any pulses produced': Observations: 3,472; pseudo-R2: 0.029. 'If sell pulses, sell more than 50 percent': Observations: 1,271; pseudo-R2: 0.028.

Base categorical variables: age of household head – "Household head aged 35 to 64 years, 0/1"; maximum educational attainment within the household – "Member with some primary schooling, 0/1"; agricultural development domain – "Mid-altitude plateau with low population density and poor market access, 0/1"; household economic category – "Other productive rural households, 0/1".

Here are some of the key findings by type of explanatory variable:

- ▶ **Household demographic characteristics** – Demographic characteristics are not strongly associated with pulse production or sales. Female-headed households are significantly more likely to produce pulses than those headed by males. However, they are no more likely to sell any share of their harvest. Two variables are associated with lower propensity to sell pulses produced – households with a greater share of workers among their members and households with heads aged 65 years and older. Whether these two associations are important to the design of programs to increase commercial production of pulses will need to be demonstrated through additional study, including on the labor requirements of pulse production relative to that for other crops with commercial potential grown by smallholders.
- ▶ **Maximum educational attainment within the household** – Education is strongly associated with whether a household produces any pulses, but not of whether any of the pulses produced are sold. Households without any educated members are significantly less likely to produce pulses than households with members with some primary school education (the base category for analysis), while households with secondary education or above are significantly more likely to produce pulses.
- ▶ **Agricultural production characteristics** – Households with smaller cropland holdings are significantly more likely to produce pulses. However, landholding size is not significantly associated with any sales of pulses produced. Households with workers who hired-out any of their labor (*ganyu*) are found to be more likely to produce pulses as well. In contrast, we find that households that hired-in some labor for crop production are more likely to sell some of the pulses they produced than are households that did not hire-in any labor. These results, coupled with those on the household demographic characteristics, suggest that there may be a labor dimension to the production and sale of pulses by smallholders that merits further study.
- ▶ **Non-farm livelihoods, credit** – Whether a household has a member with wage employment or has at least one household enterprise, both are significantly associated with the household producing pulses. While neither of these factors are associated with whether any of the pulses produced are sold, if a household did sell any of their pulses, wage employment is associated with the household being more likely to sell more than half of their harvest. Whether a household received credit does not affect pulse production, but those that received credit and produced pulses are significantly more likely to sell some of their harvest. Credit is not associated with sales of more than half of what was harvested, however.
- ▶ **Relative dependence on market for consumption** – The share of maize consumed by the household that was purchased is not associated with households deciding to grow pulses. However, it is associated with pulse sales, but the relationship is possibly counter-intuitive – households, which consume relatively higher amounts of purchased maize are significantly less likely to sell any of the pulses they produced or, if they sell any, less likely to sell a large share. Commercial pulse production is not the means these households use to obtain income to purchase maize for consumption.
- ▶ **Agricultural development domains** – The results for the six domains suggest that agro-ecological, market access, and landholding factors are important both in determining where pulses are produced and where producers are likely to produce it for sale.
  - ▷ Only households in the ‘Mid-altitude plateau with high population density and good market access’ development domain were more likely than households in the base domain, ‘Mid-altitude plateau with low population density and poor market access’, to produce pulses.

Households in the two Lakeshore development domains were significantly less likely to do so.

This pattern to where pulses are likely to be grown reflects the concentration of pigeonpea production in the Shire Highlands of southern Malawi and the relatively limited production of any pulses along the lakeshore, despite Figure 1 showing that the zone is well-suited for pulse production. On this divergence, we note that the crop suitability map is based on average agro-climatological conditions and does not consider variability in those conditions. Pulse production in the Lakeshore domains is riskier than would be indicated by only considering average conditions. With increased risks of drought or floods, in particular, farmers along the lakeshore may be less likely to produce bean, cowpea, or pigeonpea than are farmers in the mid-altitude plateau upland areas. However, these crop choices require further study.

- ▶ For pulse sales, we find a different pattern across development domains than for production. In addition to being more likely to produce pulses, households in the 'Mid-altitude plateau with high population density and good market access' are significantly more likely to sell any pulses they produce than are households in the base development domain. However, we also find that households in the 'Mid-altitude plateau with low population density and good market access', the 'Lower Shire Valley', and, somewhat surprisingly, the 'Lakeshore with low population density and poor market access' development domains also to be more likely to sell some of the pulses they produce.
- ▶ We find no development domains in which pulse-selling households are more likely than those in the base domain to sell more than half of their output.
- ▶ **Household economic category** – The only significant association for pulse production is for urban households that engage in any crop production. These households are significantly less likely to produce pulses than other households.

## Insights for design or targeting of efforts to strengthening value chains for pulses

This analysis suggests that efforts to increase small farmers' production of pulses in Malawi should focus on farmers with smaller landholdings in the mid-altitude plateau zone in southern Malawi, particularly those farming households that are female-headed. The ability to use small areas of land for growing pulses, possibly as intercrops, appears to be an important consideration in farmers' decisions to produce them.

Household labor availability also appears to be important in household's decisions to produce and to sell pulses. However, the reasons are not clear, so this association needs further study.

Finally, while Figure 1 indicates that areas along the lakeshore (and upper Shire Valley) should be well suited for pulse production, our household survey results suggest that farmers in those areas are significantly less likely to produce pulses than those farming at higher elevations. A better understanding of what drives lakeshore farmers reluctance to produce pulses is therefore needed.

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## ENDNOTES

- <sup>1</sup> Mellor, J.W. 2017. *Agricultural Development and Economic Transformation: Promoting Growth with Poverty Reduction*. Cham, Switzerland: Palgrave Macmillan.
- Hagblade, S., P.B.R. Hazell, and T.A. Reardon. 2007. *Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World*. Baltimore: Johns Hopkins University Press.
- <sup>2</sup> Me-Nsope, N.M., and F.J. Nankhuni. 2018. *An Analysis of Malawi's Pigeon Pea Value Chain*. Feed the Future Innovation Lab for Food Security Policy Research Paper 98. East Lansing, MI, USA: Michigan State University.
- <sup>3</sup> Nankhuni, F.J., and N.M. Me-Nsope. 2018. *Is the Future of Malawi's Pigeon Pea Industry at the Mercy of India? An Analysis of Malawi's Pigeon Pea Value Chain*. Feed the Future Innovation Lab for Food Security Policy Research Brief 62. East Lansing, MI, USA: Michigan State University.
- <sup>4</sup> This map was developed from output from the Land Resources Evaluation Project (LREP), which ran from 1988 to 1992. LREP was a joint government of Malawi, United Nations Development Programme (UNDP), and Food and Agriculture Organization (FAO) project that involved a close reconnaissance of the agro-ecological resources of Malawi. Extensive field work was done to map the soils across the country at the relatively detailed scale of 1:250,000 (1 cm = 2.5 km). Weather data was analyzed to generate averages for various indicators for use in mapping the agro-climatological zones of Malawi at the same geographic scale.
- The soils and agroclimate maps developed were then overlaid to develop a 'land unit' map for Malawi. Each land unit is defined by a unique combination of relatively homogeneous soil and climate properties within its boundaries. These land units were then used with information on the optimal soil and climate conditions for growing a range of rainfed agricultural crops, as well as irrigated rice and tree species, to undertake a spatial suitability analysis for the production of each in each land unit.
- For detail on LREP and the crop suitability maps produced by the project, see:
- Benson, T., A. Mabiso, and F. Nankhuni. 2016. *Detailed crop suitability maps and an agricultural zonation scheme for Malawi: Spatial information for agricultural planning purposes*. Feed the Future Innovation Lab for Food Security Policy Research Paper 17. East Lansing, MI & Washington, DC, USA: Michigan State University & International Food Policy Research Institute. <http://dx.doi.org/10.2499/9780896293403>.
- <sup>5</sup> To determine which of the three pulses examined here is most suited for production in a particular location, the user will need to consult the individual crop suitability maps in Benson, Mabiso, and Nankhuni (2016). For example, the specific crop accounting for the areas of the Salima and Nkhotakota lakeshore and further south in Balaka district that are highly suitable for pulse production is pigeonpea. However, elsewhere the spatial patterns of suitability for production are quite similar across all three pulses.
- <sup>6</sup> That this is the case is in part an artefact of the significant drought in southern Malawi and consequent food insecurity during the IHS4 survey year of 2016/17.
- <sup>7</sup> An exception is that variables on the economic category of the household are only used for the pulse production analysis. As these categories are defined in part by level of crop sales, they are not used in the sales-related analyses.
- <sup>8</sup> The development domains are defined based on the intersection of three agro-ecological zones – Lower Shire Valley (less than 250 m elevation), Lakeshore (and upper and middle Shire Valley – 250 to 650 m elevation), and Mid-altitude plateau (and highlands – above 650 m elevation); two levels of market access (less than or more than two hours travel time from one of the four major urban centers of Malawi); and two levels of population density (less than or more than 250 persons per sq. km.) See Benson, Mabiso, & Nankhuni 2016 (endnote 4 above).
- While the full combination of the three factors theoretically would allow for 12 (3x2x2) types of development domains, Malawi has only six.
- <sup>9</sup> The odds-ratio is the chance of the dependent variable changing from 0 to 1 as a result of a one-unit positive change in the explanatory variable. A statistically insignificant odds-ratio is one – that is, a one-to-one or even chance. Odds-ratios less than one indicate an inverse relationship between the independent and dependent variables, while those greater than one suggest a direct relationship.

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## ABOUT THE AUTHOR

**Todd Benson** is a Senior Research Fellow with Development Strategy and Governance Division (DSGD) of the International Food Policy Research Institute, based in Washington, DC.

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