

# Do legume-based intercrops concurrently halt soil erosion and boost soil health in cassava cropping systems in Northern Vietnam? (LEGINCROP)



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# Outline

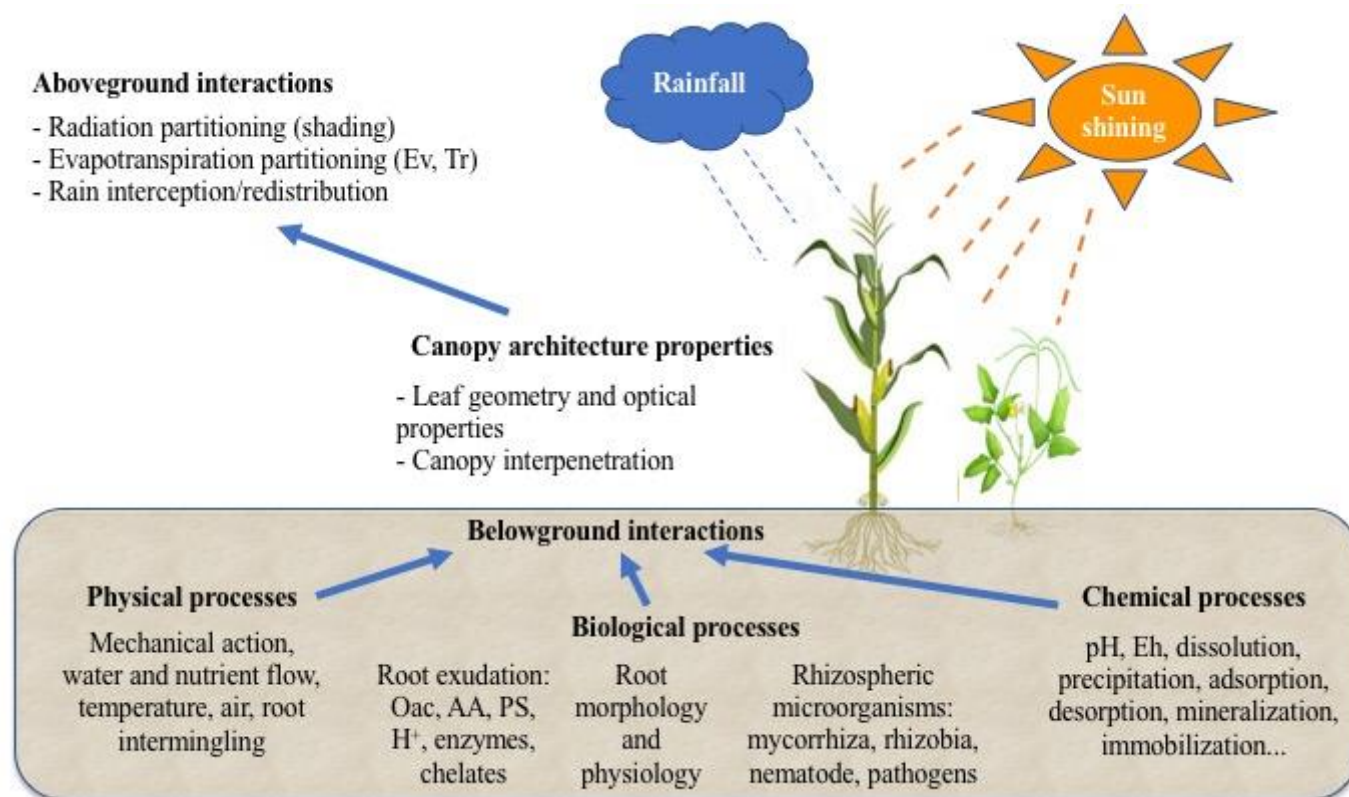
1. Intercropping with legumes
2. Situation at the beginning of the project: Yen Bai Province
3. Activities carried out in 2017 : Results and Conclusion
4. Activities carried out in 2018: Results and Conclusion
5. Way forward beyond the LEGINCROP project

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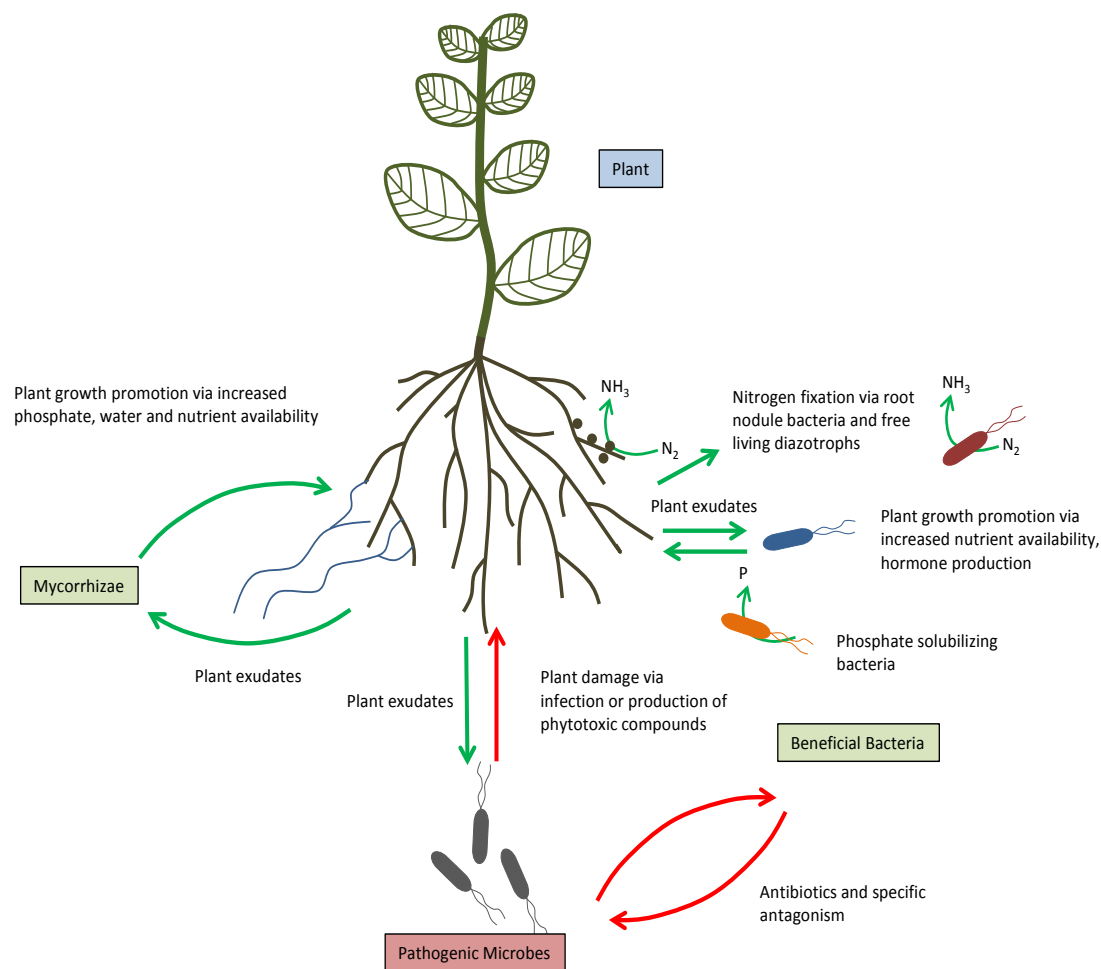
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# Intercropping with legumes

Above and belowground competition for resources in multispecies systems.  
(Adapted from Malézieux et al., 2009; Zhang et al., 2004).



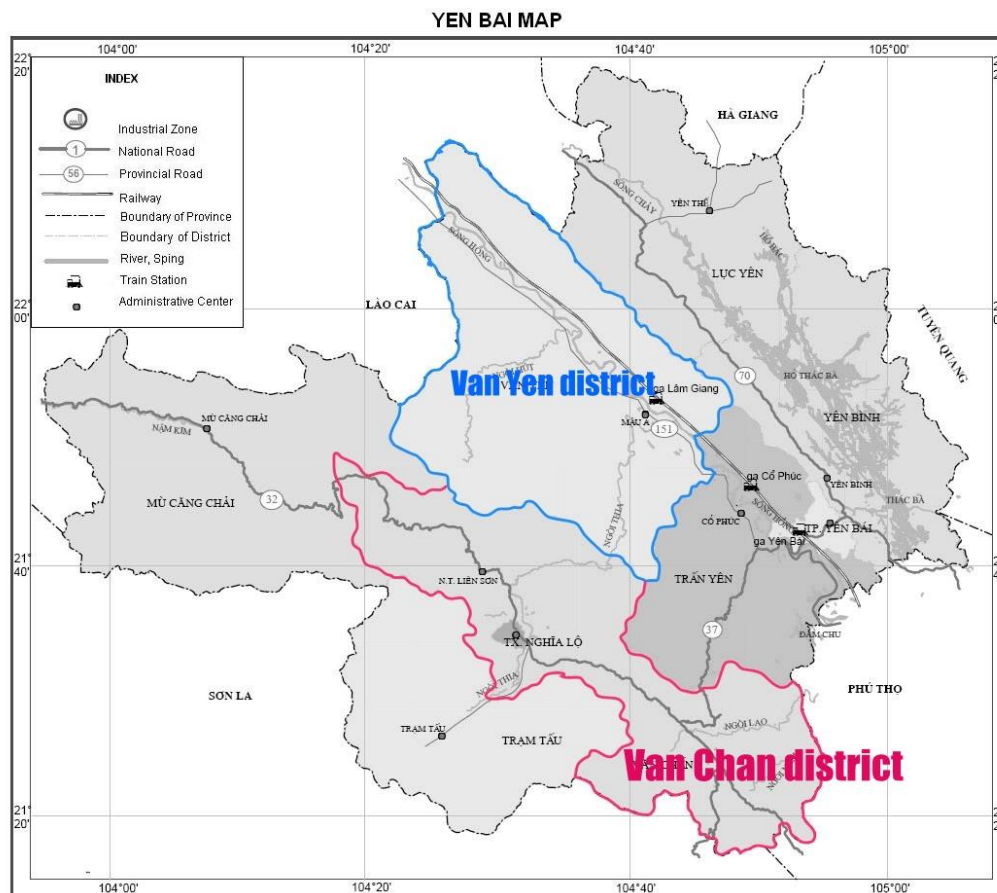
# Intercropping with legumes



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# Beginning of the project: Yen Bai Province





# Beginning of the project: Yen Bai Province



Mau Dong Commune (VY)



Son Think district (VC)



Cat Think district (VC)



# Beginning of the project: Yen Bai Province

Number of farms and areas with cassava-cowpea intercropping system at Mau Dong commune, Van Yen district, Yen Bai province, Vietnam

		2017
Number of farms	Total	95
	Cassava- cowpea intercropping farms	16
	Percentage of cassava-cowpea intercropping farms (%)	16.8
Area of growing cassava	Total (ha)	45
	Cassava- cowpea intercropping (ha)	3.7
	Percentage of cassava-cowpea intercropping areas (%)	8.2

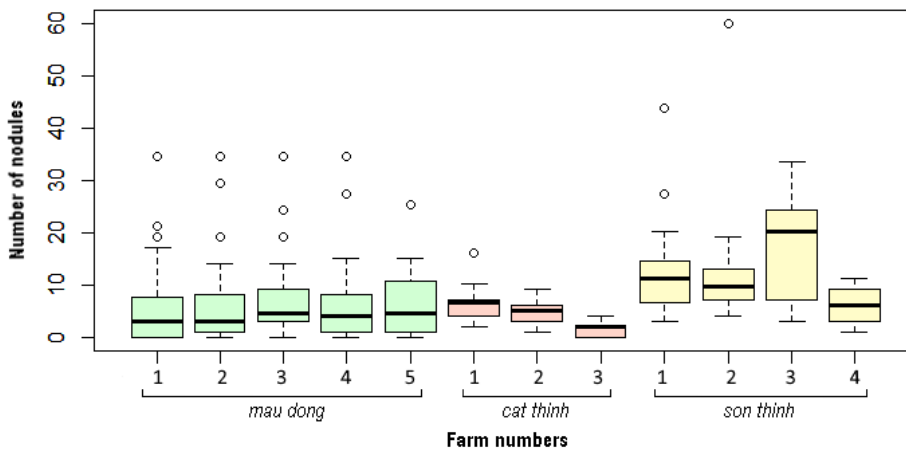
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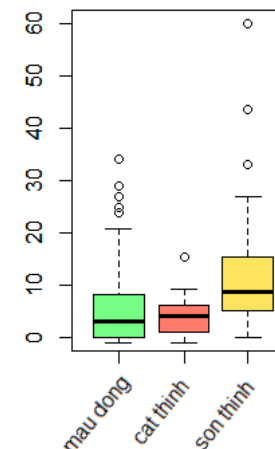
# Activities carried out in 2017 and results obtained

1. Assessment of the natural nodulation of cowpea in Mau Dong, Cat Thinh and Son Thinh without any intervention with regards to how farmers manage their cassava or maize fields
2. Determination of a possible impact of both landscape and soil characteristics on the natural nodulation of cowpea.

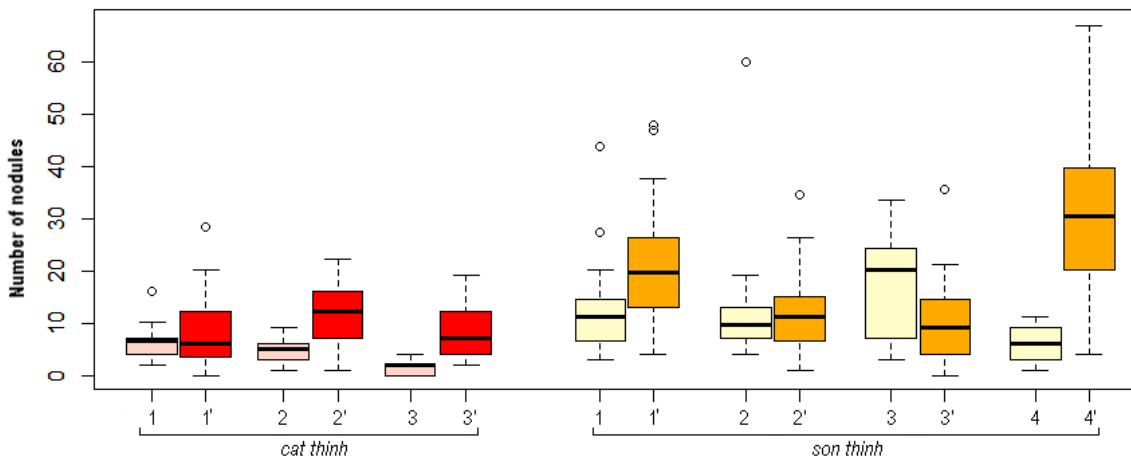
# Activities carried out in 2017 and results obtained



Distribution of the number of nodules according to each field studied (june 2017)



Distribution of the number of nodules for each town (June 2017)



# Activities carried out in 2017 and results obtained

- The nodulation of cowpea in both districts of Yen Bai Province is pretty limited with a huge variability from one farm to another one.
- $^{15}\text{N}$  analyses show the average of Ndfa is about 40% only
- For 2018, need to inoculate systematically cowpea with rhizobial inoculant (but no commercial inoculant currently available in Vietnam).
- Mycorrhization of legumes is high



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# Activities carried out in 2018 and results obtained

1. Isolation of native rhizobial strains and selection of effective ones for field inoculation in Mau Dong (greenhouse trial).
2. Impact of the inoculation with selected rhizobia on nodulation and growth of cowpea in Mau Dong.
3. Impact of the inoculation with selected rhizobia on the natural mycorrhization of both cowpea and cassava.

# Activities carried out in 2018 and results obtained

## Efficiency of native rhizobial strains under greenhouse conditions

Treatment	Shoot fresh weight (g)	Shoot dry weight (g)	Root fresh weight (g)	Root dry weight (g)	SPAD value	Shoot total N (%)
Control	3.04 <sup>d</sup>	0.48 <sup>d</sup>	0.83 <sup>d</sup>	0.12 <sup>c</sup>	17.54 <sup>b</sup>	2.18 <sup>c</sup>
N+	17.92 <sup>a</sup>	4.65 <sup>a</sup>	6.83 <sup>a</sup>	0.76 <sup>a</sup>	33.33 <sup>a</sup>	3.70 <sup>bc</sup>
CMBP037	5.33 <sup>cd</sup>	0.87 <sup>cd</sup>	3.07 <sup>b</sup>	0.27 <sup>b</sup>	30.03 <sup>a</sup>	5.21 <sup>ab</sup>
CMBP054	7.86 <sup>bc</sup>	1.37 <sup>bc</sup>	1.66 <sup>c</sup>	0.23 <sup>b</sup>	35.72 <sup>a</sup>	6.53 <sup>a</sup>
CMBP065	9.69 <sup>b</sup>	1.92 <sup>b</sup>	2.51 <sup>bc</sup>	0.33 <sup>b</sup>	38.35 <sup>a</sup>	5.48 <sup>ab</sup>

Means followed by different letters are significantly different at  $P < 0.05$ . Means separated by Tukey's test.

# Activities carried out in 2018 and results obtained

## Field inoculation with selected rhizobial strains in Mau Dong

Treatment	Nodulation (number of nodules per plant)	Shoot dry weight (g plant <sup>-1</sup> )	Root dry weight (g plant <sup>-1</sup> )	Shoot total N (%)	Yield (kg ha <sup>-1</sup> )
Non_I	11.3 <sup>a</sup>	17.62 <sup>a</sup>	1.76 <sup>a</sup>	2.88 <sup>a</sup>	384.26 <sup>a</sup>
CMBP037+054	19.2 <sup>a</sup>	23.14 <sup>a</sup>	1.81 <sup>a</sup>	3.02 <sup>a</sup>	407.56 <sup>a</sup>
CMBP065	12.3 <sup>a</sup>	16.21 <sup>a</sup>	1.57 <sup>a</sup>	2.85 <sup>a</sup>	424.66 <sup>a</sup>

Means followed by different letters are significantly different at  $P < 0.05$ . Means separated by Tukey's test.

# Activities carried out in 2018 and results obtained

Field inoculation with selected rhizobial strains in Mau Dong:  
=> effect of landscape (slope)

Slope category	Treatment	Nodulation (number of nodules per plant)	Shoot dry weight (g plant <sup>-1</sup> ) <sub>1)</sub>	Root dry weight (g plant <sup>-1</sup> )	Shoot total N (%)	Yield (kg ha <sup>-1</sup> )
<b>p-value</b>		0.316	0.316	0.258	0.0125**	
<b>Gentle slope</b>	Non_I	14.5a	19.47a	2.05a	2.88a	
	CMBP037+054	12.7a	20.54a	1.80a	2.99a	
	CMBP065	5.8a	15.97a	1.52a	2.51b	
<b>p-value</b>		0.0004***	0.0491*	0.268	0.0001***	
<b>Moderate slope</b>	Non_I	13.7b	18.45b	1.64a	2.80c	
	CMBP037+054	33.0a	30.20a	2.23a	3.03b	
	CMBP065	11.8b	17.29b	1.81a	3.45a	
<b>p-value</b>		0.0001***	0.0148**	0.839	0.0015***	
<b>Steep slope</b>	Non_I	7.6b	15.67b	1.57a	2.92a	
	CMBP037+054	25.0a	23.86a	1.41a	3.12a	
	CMBP065	14.6a	15.92b	1.50a	2.77b	



# Activities carried out in 2018 and results obtained

Field inoculation with selected rhizobial strains in Mau Dong  
=> Effect on mycorrhizal infection

Treatment	Cowpea mycorrhizal infection rate (%)	Cassava mycorrhizal infection rate (%)
Non_I	84.37 <sup>a</sup>	65.66 <sup>a</sup>
CMBP037+054	86.70 <sup>a</sup>	67.52 <sup>a</sup>
CMBP065	84.52 <sup>a</sup>	60.45 <sup>a</sup>

# Activities carried out in 2018 and results obtained

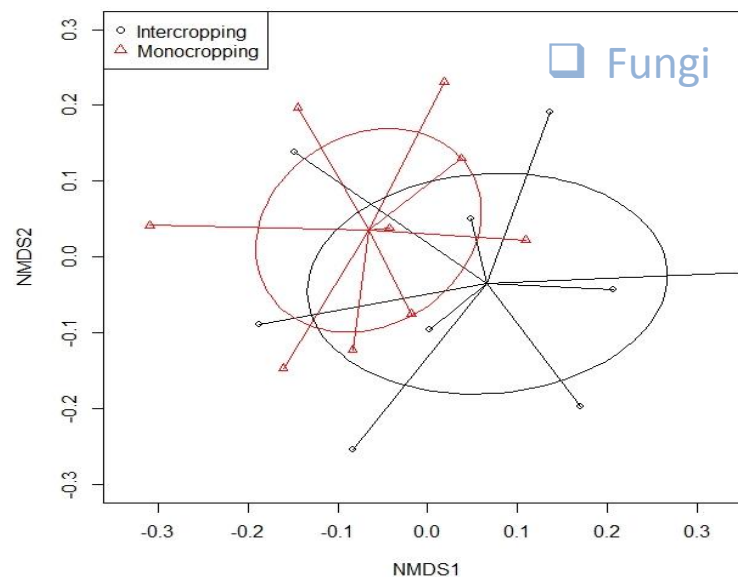
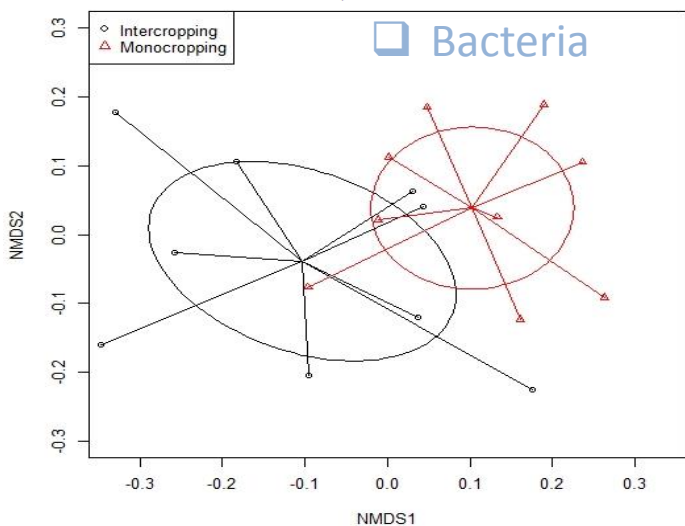
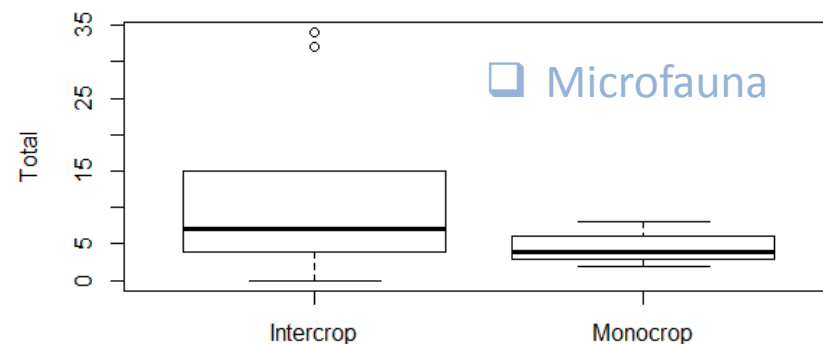
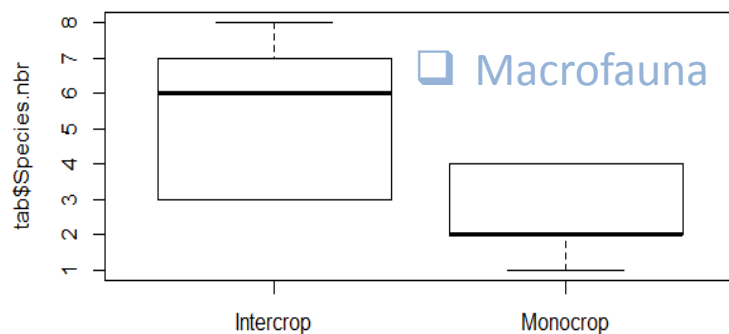
- Enhancement of the cowpea nodulation and growth by inoculation with the local MD's strains: significant link with the landscape.
- Mycorrhization of cassava is much lower than the mycorrhization of cowpea but no impact of the rhizobial inoculation.
- Cowpea yields are expected.

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# Way forward beyond LEGINCROP

## - Effects on other soil functions/communities?



# Way forward beyond LEGINCROP

Number of farms and areas with cassava-cowpea intercropping system at Mau Dong commune, Van Yen district, Yen Bai province, Vietnam

		2017	2018
Number of farms	Total	95	95
	Cassava- cowpea intercropping farms	16	52
	Percentage of cassava-cowpea intercropping farms (%)	16.8	54.7
Area of growing cassava	Total (ha)	45	45
	Cassava- cowpea intercropping (ha)	3.7	18
	Percentage of cassava-cowpea intercropping areas (%)	8.2	40.0



# Way forward beyond LEGINCROP

- To keep up the positive dynamic of farmers willing to do intercropping, need to extend the actions to other districts and other provinces.
- If more and more farmers are asking for rhizobial inoculants, need to sustain the production and to make the products available on the market:  
=> Project on Biofertilizers (ACIAR)

# Thank you very much

