

Current State of Precision Agriculture in Benin: opportunities and challenges



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Outline

- ❑ Key data about Benin
- ❑ Definitions of Precision Agriculture (PA)
- ❑ Research/actions on PA in Benin
- ❑ Opportunities and challenges
- ❑ What's next?



Key data_Benin



Area: 114 763 km²

Population ~ 11.5 million in 2018



Key data_Benin

- Many ethnic groups and more than 50 indigenous language
- Official language is French / Introduction to basic English in school
- Agriculture plays an important role



Key data_Benin

- Agriculture employs ~ 70% of Benin's workforce and contributes approximately 23% of the Gross Domestic Production (PAG, 2016).
- Crops grown: Cotton, Pineapple, Cashew, palm tree..... Cash crops
- Maize, rice, yams, cassava vegetables and fruits are grown for local subsistence and for export to neighboring countries



Definitions of Precision Agric.

- More than 27 definitions of PA (<https://www.ispag.org/>) from 1994-2016
- **PA:** *Precision Agriculture is a **management strategy** that gathers, processes and analyzes **temporal, spatial and individual data** and combines it with other information to **support management decisions** according to estimated variability for improved **resource use efficiency, productivity, quality, profitability** and **sustainability** of agricultural production (International Society of Precision Agriculture, 2018)*



Definitions of Precision Agric

How to generate knowledge to reduce uncertainty?

○ **PA:** Tool for right decision

What is the cost of ignorance?

- ❖ **Right** crop
- ❖ **Right** inputs
- ❖ **Right** crop arrangement
- ❖ **Right** application time/dose
- ❖ **Right** pest management strategies
- ❖ **Right** product
- ❖ **Right** market
- ❖ **Right** time



Research/Actions on PA in Benin

- **Right amount of Fertilisers in horticultural crops production and maize: Microdosing technologies (MT)/ Climate smart technologies**

- MT= the recommended dose at planting or a few localized application of a small rate of fertilisers (one-fourth or one third some weeks after planting

(Camara et al. 2013)



Research/Actions on PA in Benin

- **Yield and WUE** of local amaranth and African eggplant **increased with microdosed treatments** of N with manure level up to 40 kg.ha⁻¹ (Likpètè et al. 2019)
- **On Maize: increase in maize grain yield by 64% to 132%** (Tovihoudji, 2018)



Research/Actions on PA in Benin

- **Right amount of Fertilisers in cash crop: Field specific nutrient management (FSNM)**
 - **FSNM**= Usage of soil sampling to make management recommendations, does not require the use of any computerized technology, but a nutrient application based on fertilizer recommendation tables (Gandonou and Dillon, 2017)



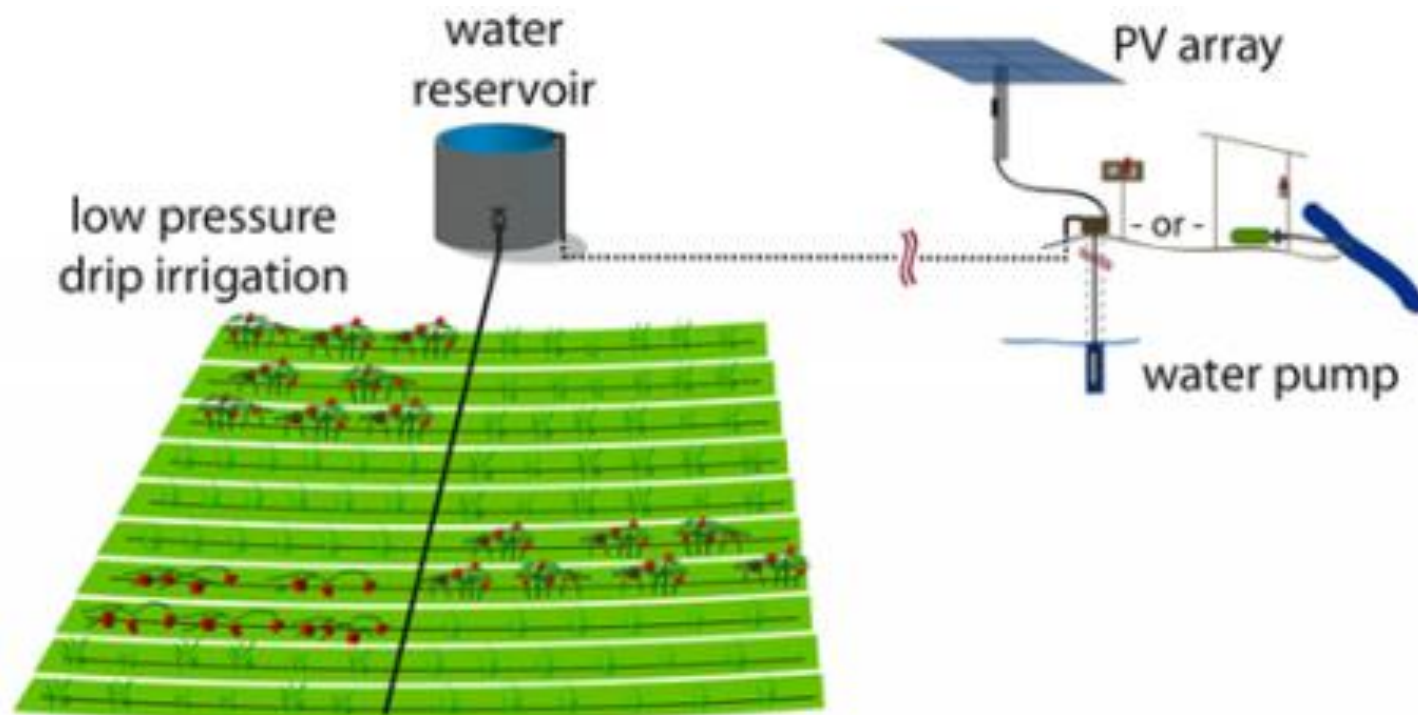
Research/Actions on PA in Benin

- **Application on Cotton crop in Benin:** Need information on soil content (so need to have a soil sampling and analysis Lab) and comparison with crop requirement from tables (Tovihoudji, 2018)
- **Application on palm tree crop in Benin:** Need to have leaf samples analysed and adjust fertilisers (N and K based) application rate (Dubos et al. 2019) ~ not applied by many producers



Research/Actions on PA in Benin

- **Crop Irrigation: Solar power drip irrigation systems in Horticultural crops: Optimization of water use**



Credit: <https://fse.fsi.stanford.edu/>



Research/Actions on PA in Benin

- **Application in Kalale village in Benin:** increased fruit and vegetable yield, crop diversification, increase in income ~ used by many households in Kalale in Northern part of Benin/limited access to water (Alaofe et al. 2016)

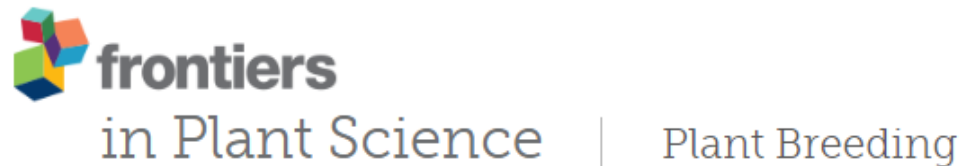


Credit: <https://fse.fsi.stanford.edu/>



Research/Actions on PA in Benin

- **Seed priming:** increase in yield






SECTION ABOUT ARTICLES RESEARCH TOPICS FOR AUTHORS EDITORIAL BOARD ARTICLE ALERTS

Articles

ORIGINAL RESEARCH ARTICLE



Front. Plant Sci., 21 January 2015 | <https://doi.org/10.3389/fpls.2014.00798>

Influence of weight and type of planting material on fruit quality and its heterogeneity in pineapple [*Ananas comosus* (L.) Merrill]

 **V. Nicodème Fassinou Hotegni^{1,2}**,  Willemien J. M. Lommen^{1*},  Euloge K. Agbossou² and  Paul C. Struik^{*}

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9,028
TOTAL VIEWS

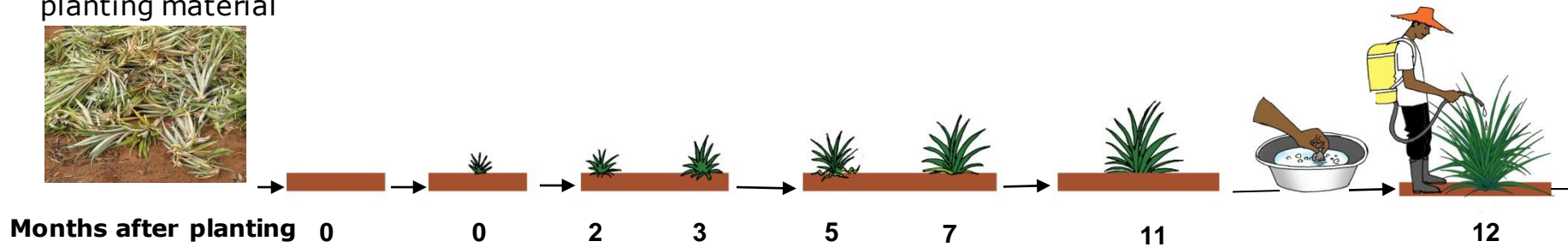
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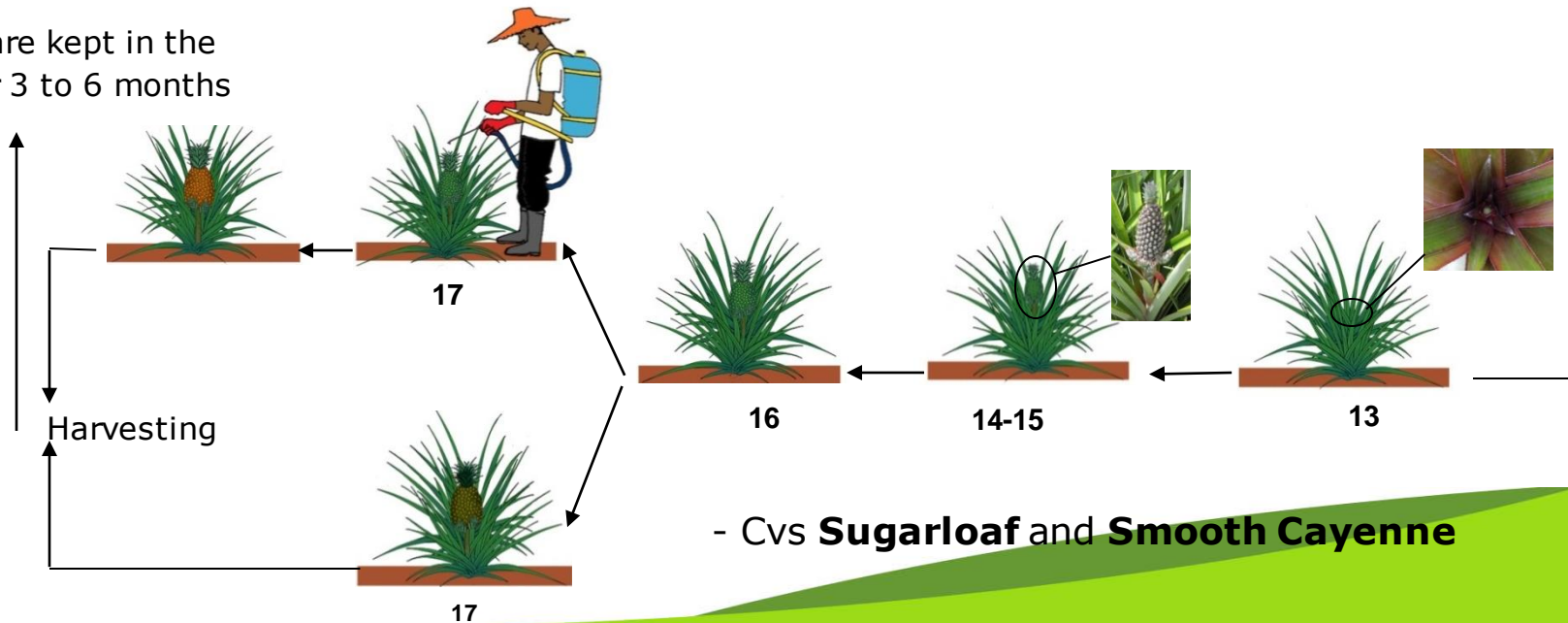


Pineapple agronomic practices

Heap of pineapple planting material



Plants are kept in the field for 3 to 6 months

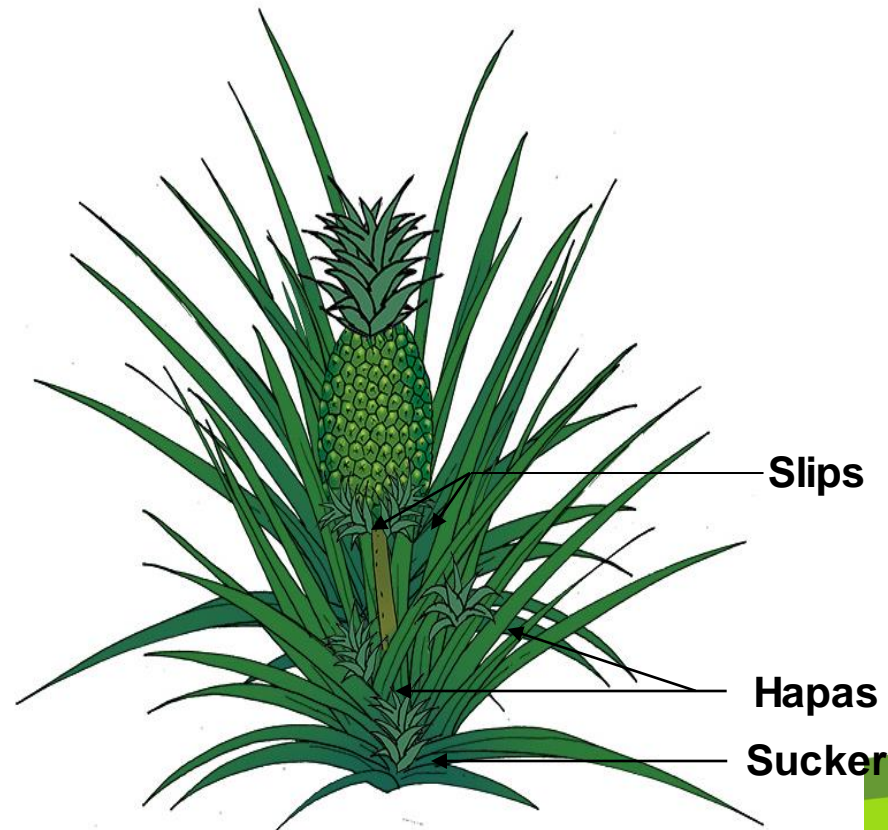


- Cvs **Sugarloaf** and **Smooth Cayenne**



Research/Actions on PA in Benin

- **Pineapple planting material weighting 325-550g** gave high yield along with high pineapple quality (Fassinou Hotegni et al. 2015)



Research/Actions on PA in Benin

- **Pineapple planting material weighting 325-550g** at a planting density of $66600 \text{ plants.ha}^{-1}$ and a fertilizer application at **$K_2O:N=1$** gives: average weight of a fruit **1.15 kg** and a yield of **75.6 tons/ha** with a shelf life of at least **10 days**



Research/Actions on PA in Benin

Slip development in cv. Sugarloaf



Slips at 2 months after flower emergence

- Selective slip pruning did not lead to consistent improvement in fruit quality attributes and uniformity in fruit quality
- Pruning time had no effect on fruit quality attributes



Slips at 3 months after flower emergence

Farmers are not advised to prune the slips



Research/Actions on PA in Benin

Fassinou Hotegni *et al.* *SpringerPlus* (2015) 4:129
DOI 10.1186/s40064-015-0907-9

 SpringerPlus
a SpringerOpen Journal

RESEARCH

Open Access

Selective pruning in pineapple plants as means to reduce heterogeneity in fruit quality

V Nicodème Fassinou Hotegni^{1,2}, Willemien J M Lommen^{1*}, Euloge K Agbossou² and Paul C Struik¹

Abstract

Heterogeneity in fruit quality (size and taste) is a major problem in pineapple production chains. The possibilities were investigated of reducing the heterogeneity in pineapple in the field by pruning slips on selected plants, in order to promote the fruit growth on these plants. Slips are side shoots that develop just below the pineapple fruit during fruit development. Two on-farm experiments were carried out in commercial fields in Benin with a cultivar locally known as Sugarloaf, to determine (a) the effect of slip pruning on fruit quality; (b) whether the effect of slip

Research/Actions on PA in Benin

Développement des pratiques agronomiques et de transformation appropriées pour une amélioration de la compétitivité de la filière ananas au Bénin

Fiche synthétique présentant les pratiques agronomiques de production d'ananas destinés à la consommation sous forme de fruit et à la transformation en jus d'ananas

Djido U., **Fassinou Hotegni V.N.**, Kpènavoun Chogou S., Lommen W.J.M., Hounhouigan M.H., Chadaré F., Hounhouigan J. D., Achigan-Dako E. G., Struik P.C., 2019. Fiche synthétique présentant les pratiques agronomiques de production d'ananas destinés à la consommation sous forme de fruit et à la transformation en jus d'ananas, ISBN 978-99982-51-64-9, Dépôt Légal N°11381 du 28/06/19 Bibliothèque Nationale du Bénin, 2ème Trimestre.



Use of drones in Agric. in Benin



Research/Actions on PA in Benin

- **Started in Benin in 2017/** initiated by **Global Partners** led by Dr ir Lawani Abdelaziz
- Project funded by CTA
- Test the viability of **unnamed aerial vehicle** (drones) services in the context of **small-scale irrigated rice farming systems in Benin**
- Global Partners in collaboration with Eastern Kentucky University

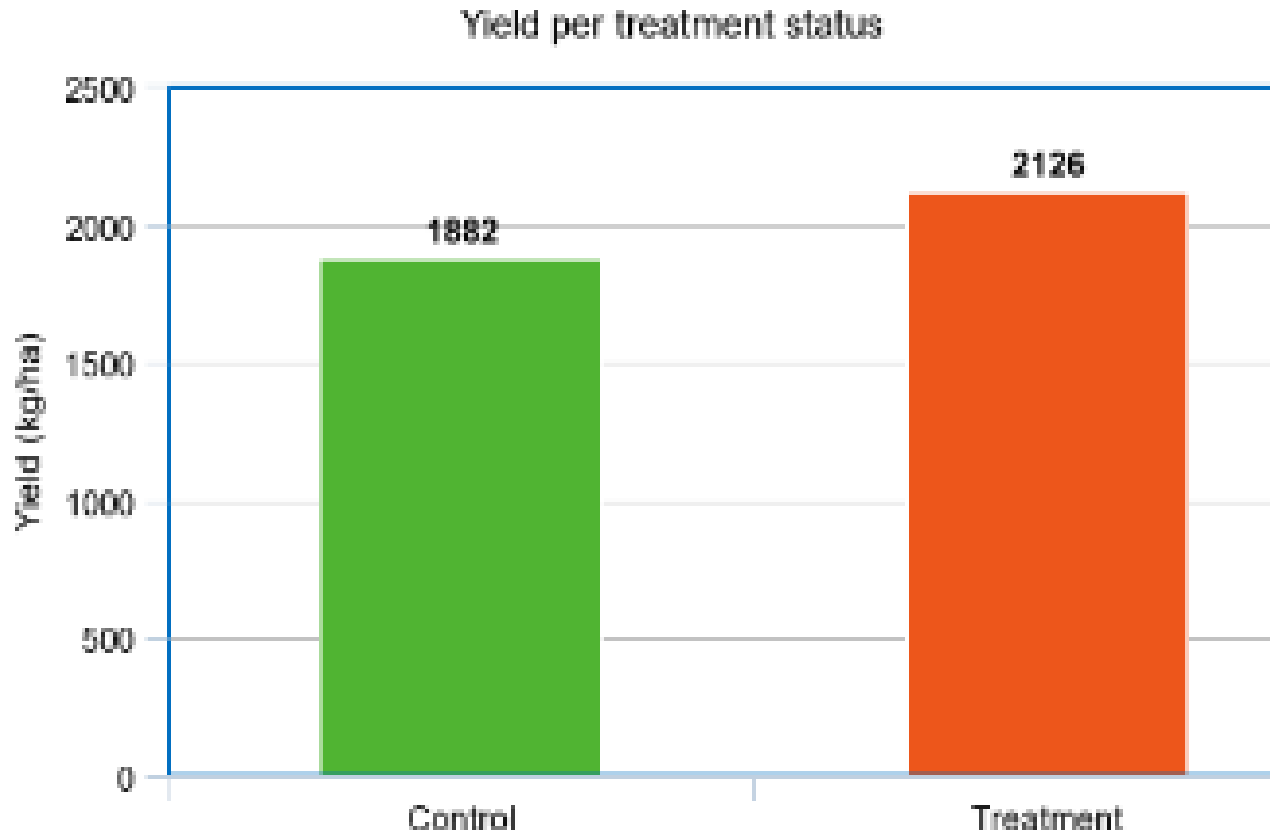


Research/Actions on PA in Benin

- **Two villages in Glazoué were selected:** distant from 15 km (110 farmers in the treatment village and 90 farmers in the control village)



Research/Actions on PA in Benin

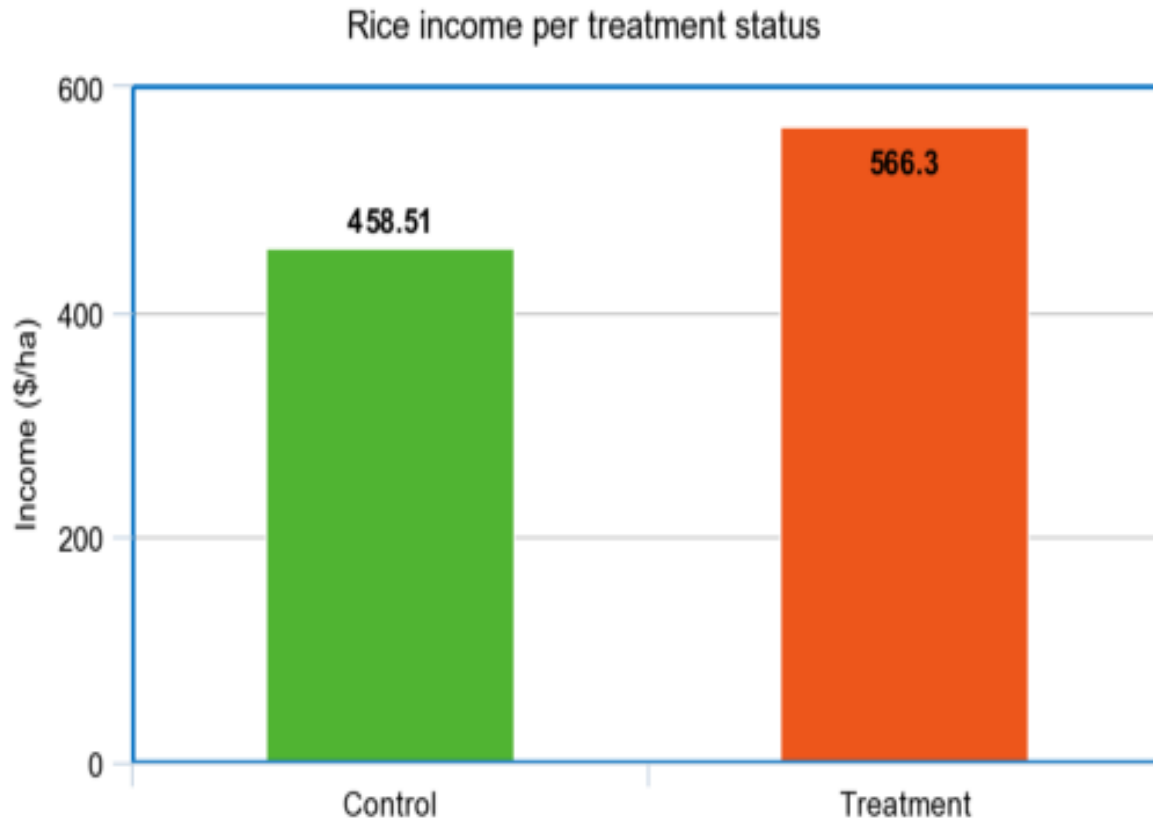


*Increase in yield
by 13%*

Source: Lawani et al. (2019)



Research/Actions on PA in Benin

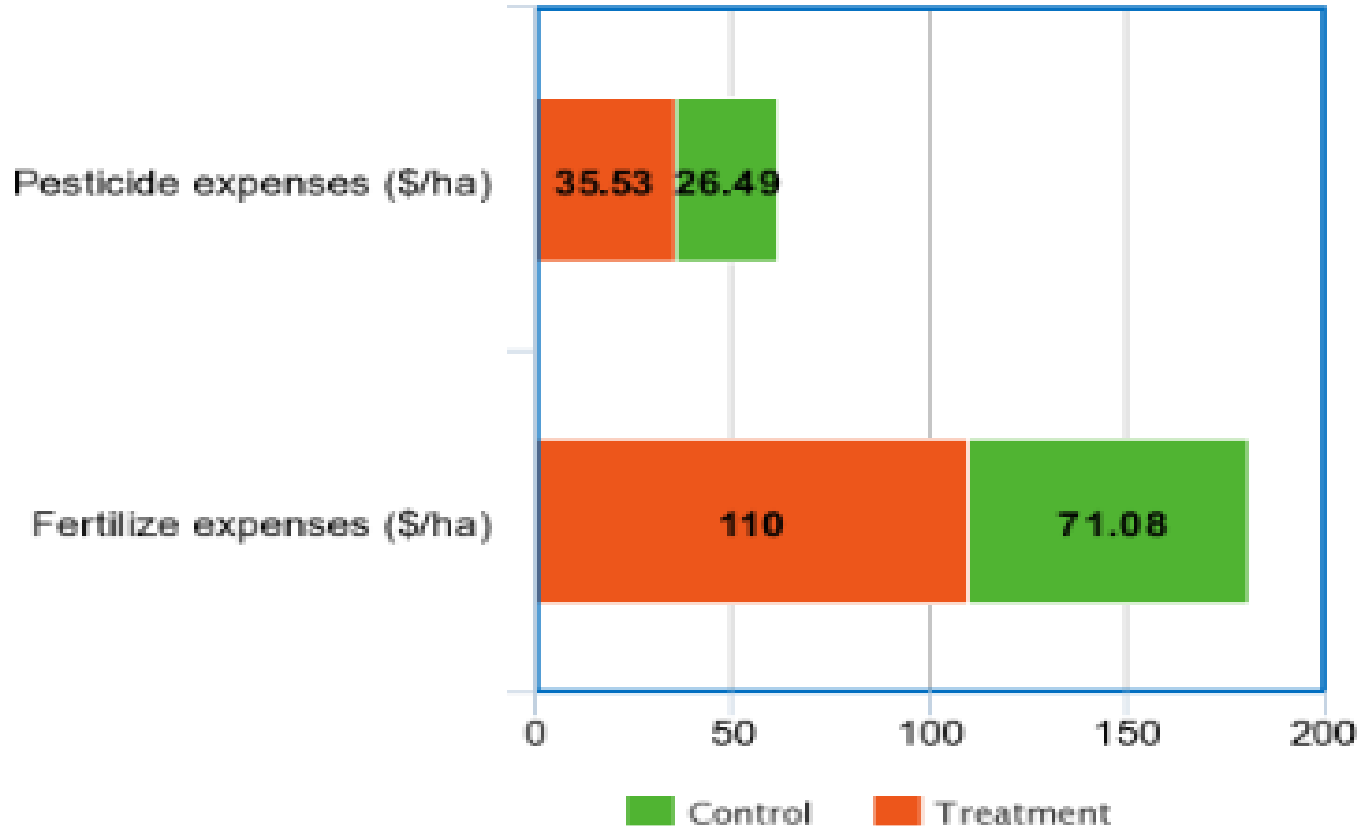


Increase in gross income by 24%

Source: Lawani et al. (2019)



Research/Actions on PA in Benin



Not expected!

34% increase in pesticide expenses

55% increase in fertilizers expenses

But can be explained

Source: Lawani et al. (2019)

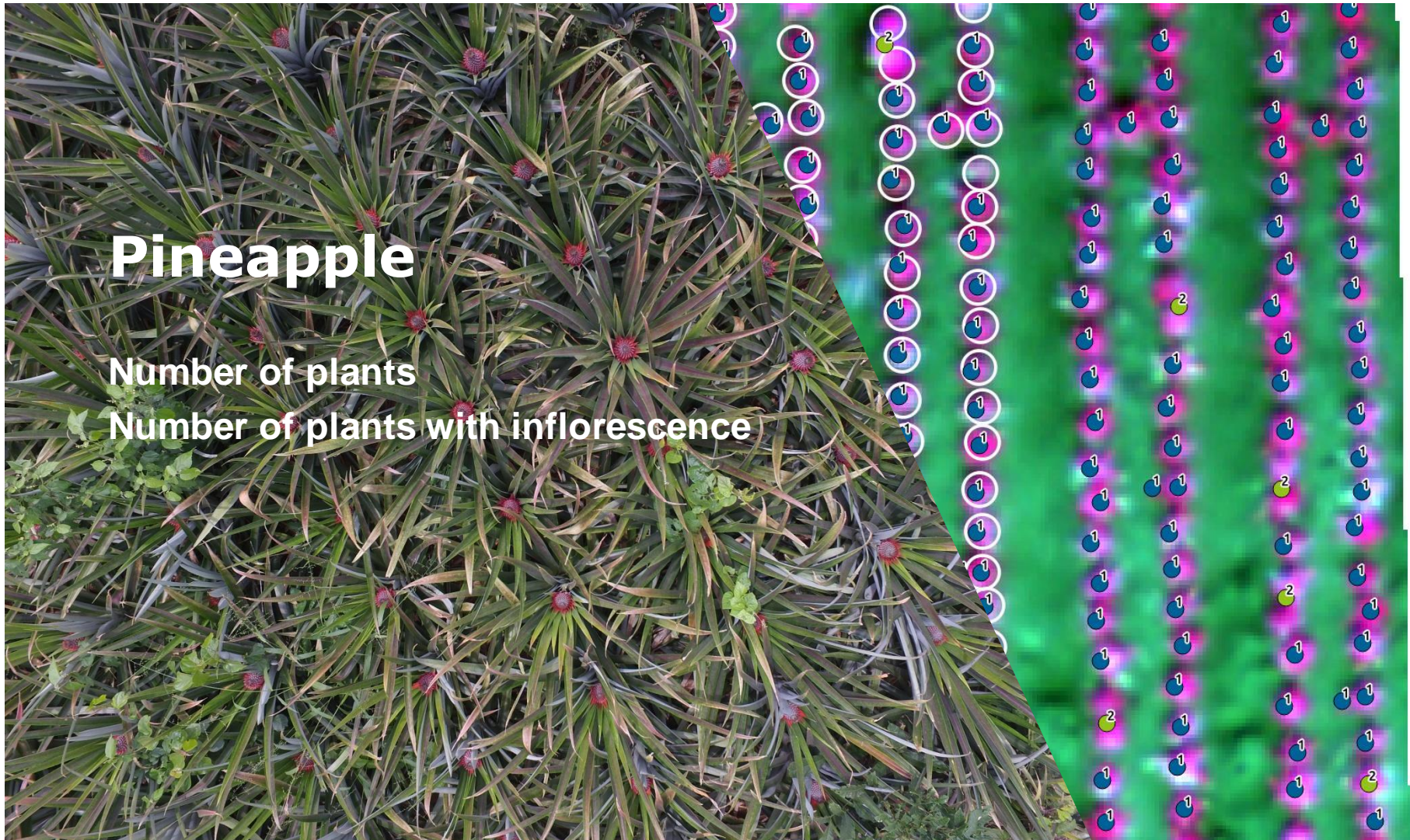


Research/Actions on PA in Benin

- Farmers are willing to pay for drone services if there is a market for drone service
- Technical support from extension agents
- Experience increase in the income and if the increase of the income is offset by the cost of drone service



Research/Actions on PA in Benin



Opportunities

- Tool to increase the yield (site specific crop management) and farmers income
- Improve farmers access to more lucrative markets
- Farmers willingness to pay for drone services
- Improve farmers resilience



Challenges

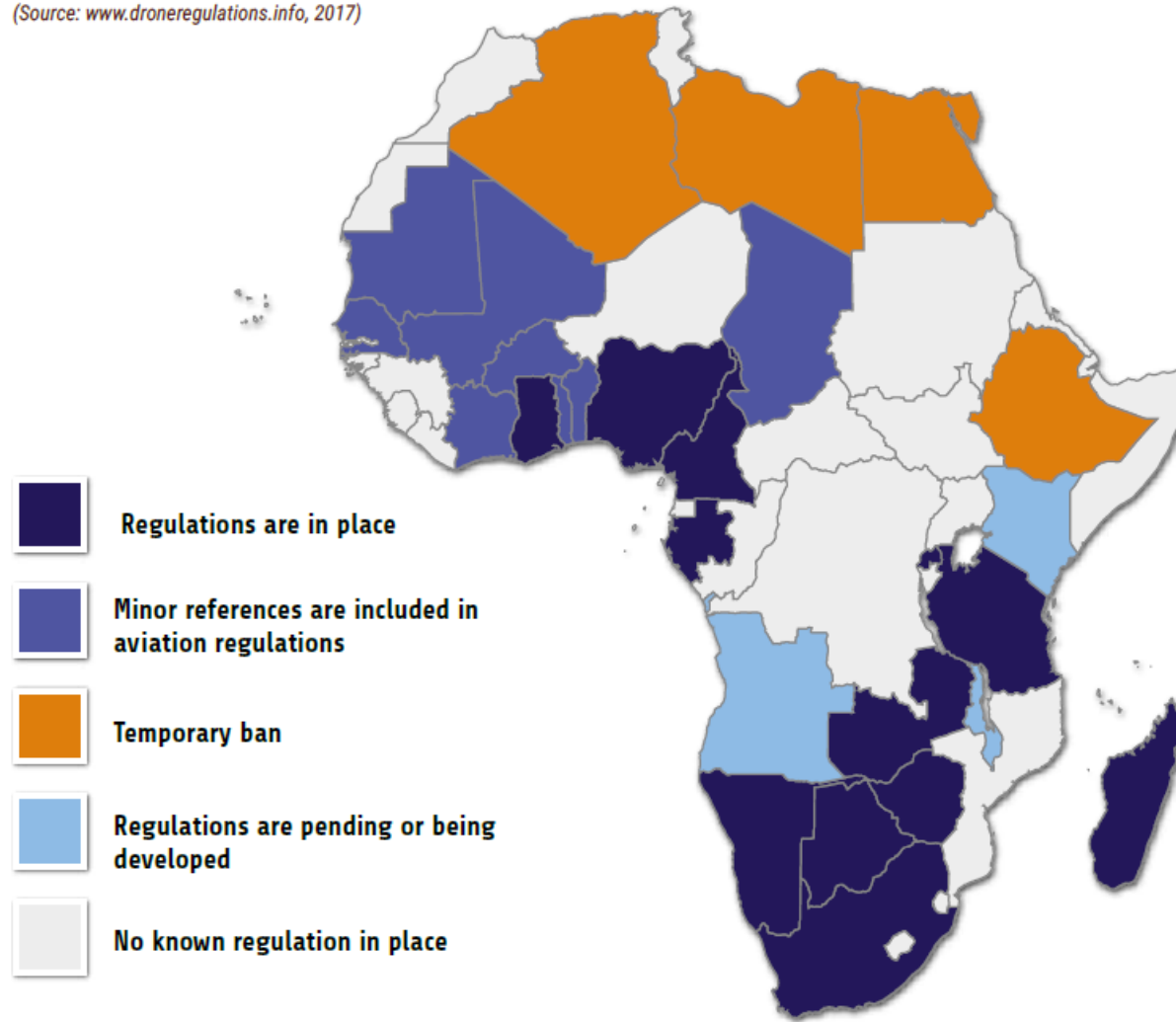
- Poor knowledge of farmers on the benefits of using precision agriculture tools (high cost of ignorance!)
- Scale out proven precision agriculture technologies/government support
- Establishment of precision agriculture markets/hubs to provide assistance



Challenges

- Need to have a clear regulation in place for UAV

Figure 5: Status of UAV regulations in Africa
(Source: www.droneregulations.info, 2017)



What's next

- West African Forum on Precision Agriculture/**Nice initiative**
- Need to capitalise all technologies, document and adapt them to other areas
- Scale out proven and adapted technologies to farmers conditions
- Develop active platform for PA actors in West Africa to share knowledge, advance science on



Acknowledgements



GLOBALPARTNERS



GBioS

**THE LABORATORY OF GENETICS,
HORTICULTURE AND SEED SCIENCE**





Thanks for your attention

