



**Ministry of Agriculture, Livestock and Irrigation**  
**Department of Agriculture**  
**Horticulture and Plant Biotechnology Division**



# **Monitoring the incident of genetically modified maize in cultivated fields around Myanmar**

Presented by

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# Maize in the world

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- Originated in central Mexico 7000 years ago
- Better source of food and industrial products, including starch, oil, protein, industrial alcohol, food sweeteners, and fuel ethanol
- Contains approximately 72% starch, 10% protein, and 4% fat, energy 365 Kcal/100 g
- Of the global area of 197.2 million hectares of biotech crops (USDA,2018), biotech maize - 30% (58.9 million hectares)
- 18 countries grows biotech maize (USDA, 2018), including Philippines,Vietnam

# Utilization of biotech maize around the world

## Cultivation

- USA, Canada, Spain, Portugal, Vietnam, Phillipines, South Africa, Brazil, Argentina, Bolivia, Chile, Colombia, Honduras, Mexico, Uruguay, Paraguay, Australia, Costa Rica

## Food, feed and processing

- **China**, Honduras, Chile, Argentina, Australia, Canada, Colombia, Costa Rica, Cuba, Egypt, Indonesia, Iran, **Japan**, Mexico, Nigeria, Brazil, **Pakistan**, Panama, Paraguay, Philippines, Russia, Singapore, South Africa, Taiwan, **South Korea**, Switzerland, **Thailand**, Turkey, United States, Uruguay, Vietnam

## Research

- China, Honduras, Chile, Argentina, Australia, Canada, Colombia, Costa Rica, Cuba, Egypt, Indonesia, Iran, Japan, Mexico, Nigeria, Brazil, Pakistan, Panama, Paraguay, Philippines, Russia, Singapore, South Africa, Taiwan, South Korea, Switzerland, Thailand, Turkey, United States, Uruguay, Vietnam

- Neither GM maize plants nor seeds is approved to cultivate in fields currently. ( Myanmar Seed Law)

# Transgene in environment

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- Benefit of biotech crops, such as higher crop yields, reduced farm costs, increased farm profits, increased nutritional traits and improved environment
- Care should be taken: the GM crop escapes unintendedly in the environment, it may cause genetic contaminations in the conventional fields
- **In South Korea and China; not approved GM soybean varieties found at local open markets (Shim, Nam, Choe, Jeong, & Chung, 2006; Zhou, Liu, Lian, & Zhang, 2007)**
- **In South Korea; have not been approved Bt10 maize for field cultivation but Bt10 maize contamination was found in seed lots (Macilwain, 2005)**

**Despite not approved yet, Myanmar has not investigated whether GM maize plant is cultivated and (or) contaminated.**



# Objective

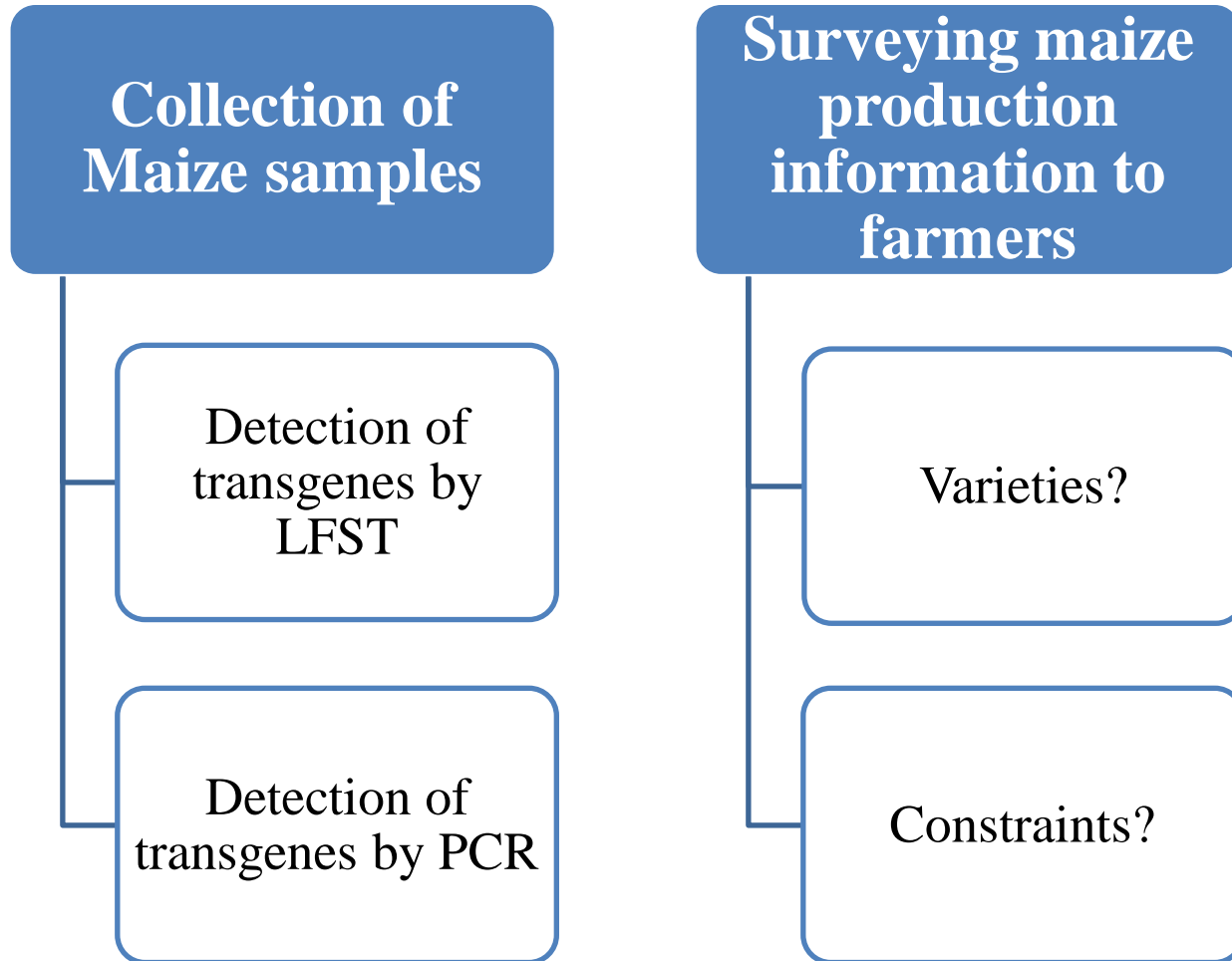
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- To detect incident of GM maize in the area of cultivated maize field and maize brokers' sales center for not only environmental safety management but also for supporting of trade market

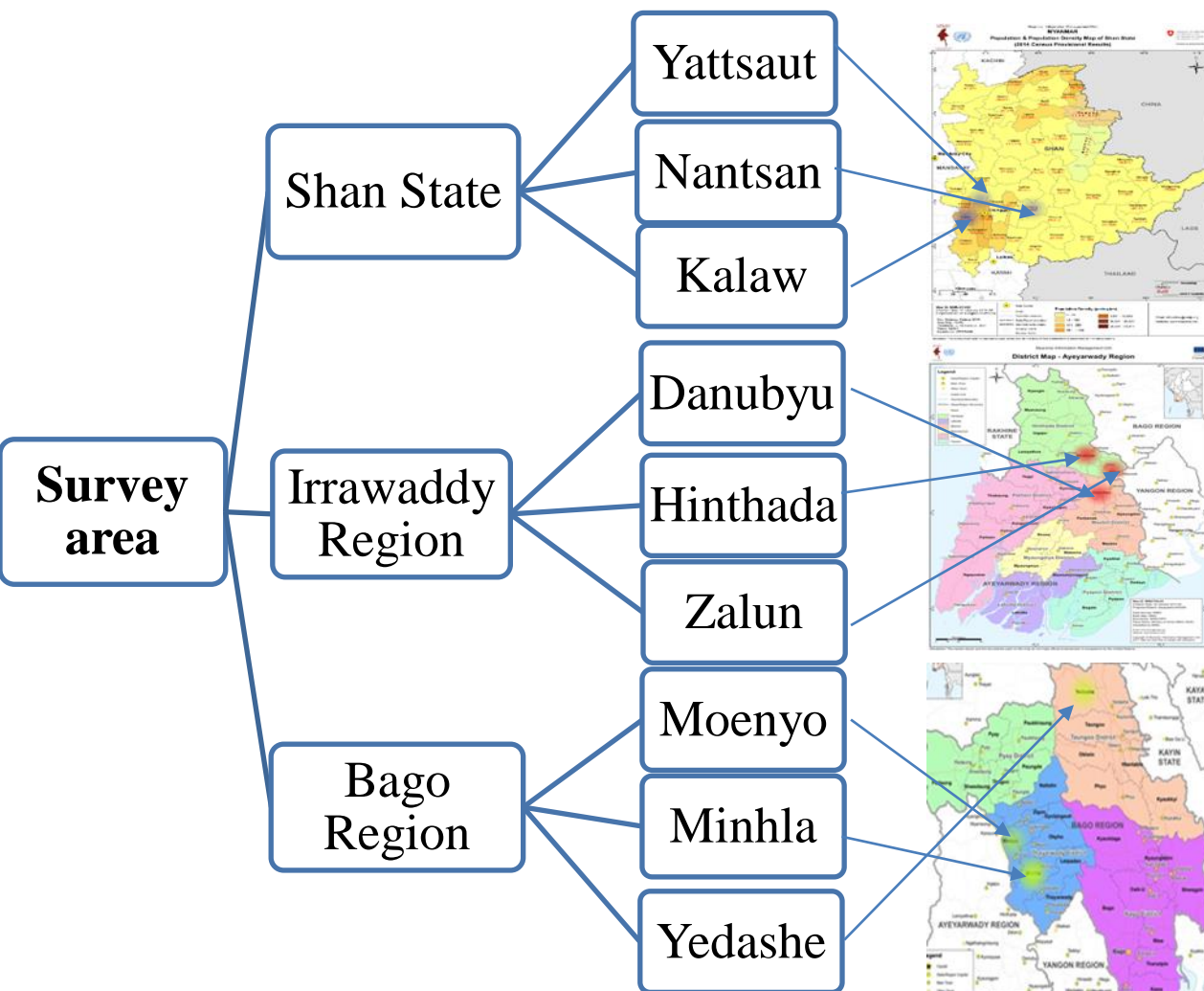


# Methodology

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# Surveying and sampling



Sample household	Total acres	Survey acres	Maize brokers' sales center
10	50477	178	3
10	4123	52	3
9	21427	267	3
Sample household	Total acres	Survey acres	Maize brokers' sales center
9	1622	22	3
10	14432	35	2
7	3293	33	3
Sample household	Total acres	Survey acres	Maize brokers' sales center
11	8576	71	3
2	70	11	2
7	1118	28	2



# Surveying maize growing farmers

➤ Surveys were conducted during 2019 (Dec) – 2020 (Feb)

➤ Sampling ; total - 27 study sites

total- 99 household samples

➤ Collected information were: - maize crop production

- maize seed varieties

- the difficulties encountered in maize production

- marketing, input, labor and expectations

- other comments



# Surveying maize leaves

## ➤ leaf samples collection

- Five plants/site

Total - 405 samples (27 x 3 x 5)

## ➤ maize grain samples collection

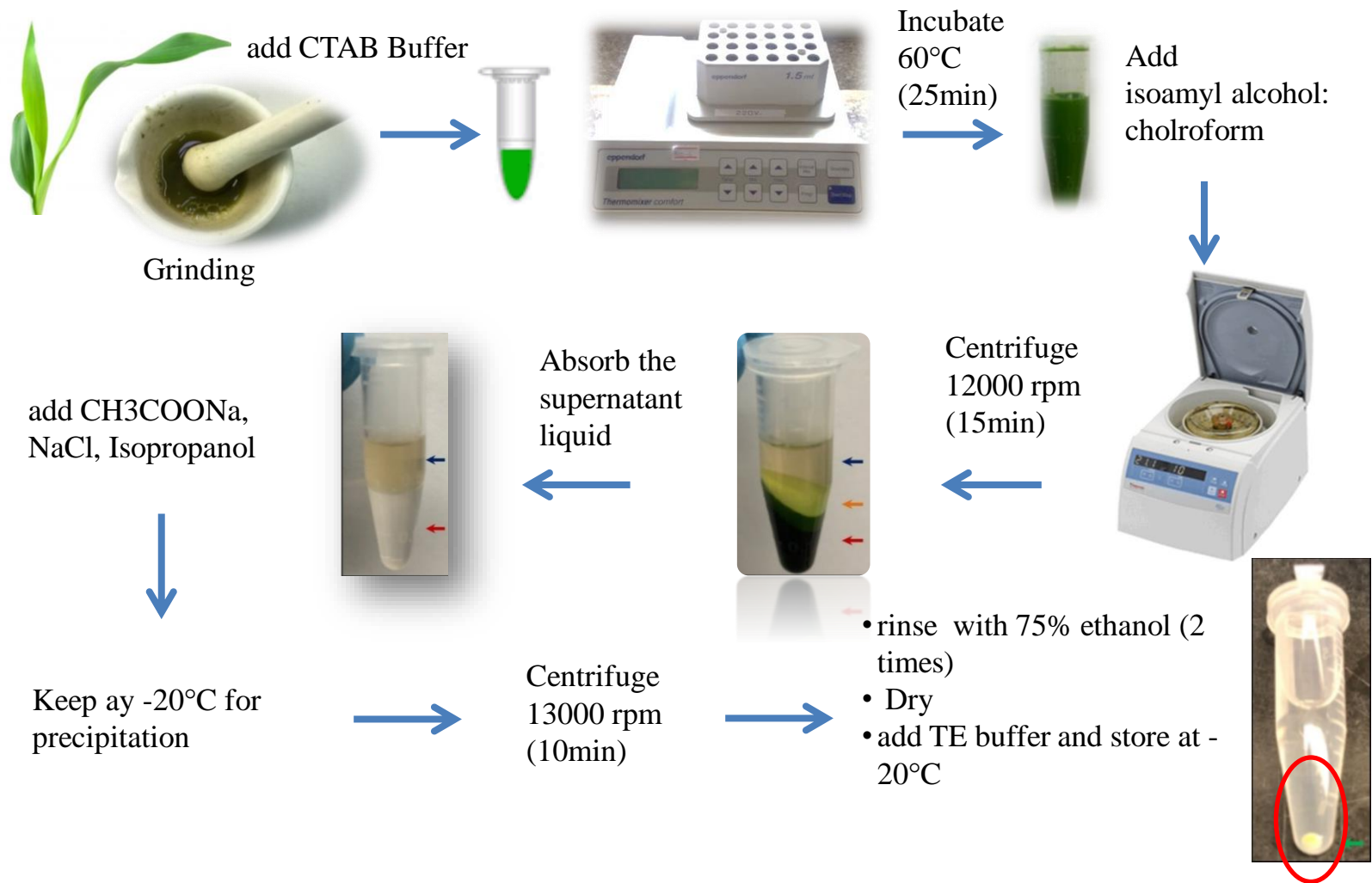
Total - 72 samples (24 x 3)

(brokers' sales center along the road sides)

## ➤ Detection of maize samples by LFST and PCR

- LFST (Cry1Ab, CP 4 EPSPS, Cry 3 Bb, Cry1F, PAT/pat, Cry 34, mCry3A)
- DNA extraction (CTAB method)
- Specific primer (35S, nos, and *nptII*)

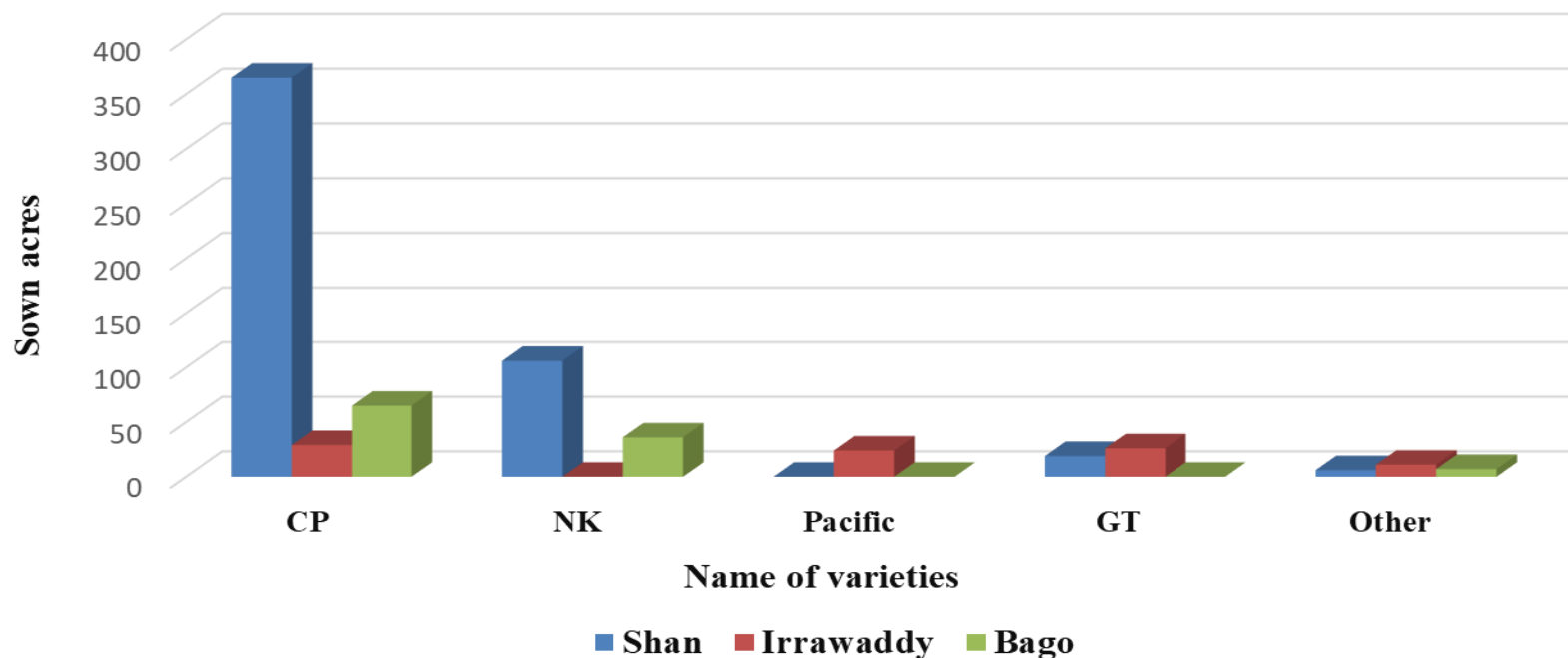




## DNA extraction from plants (CTAB-Base method)

# Result and Discussion

## ➤ Maize grower using different varieties of maize seed



**Fig 1.Different varieties of maize seed using in survey area**

- The most sown maize varieties are CP (ChoernPakard ) hybrids and NK hybrids.
- CP varieties mostly influenced on the maize production in survey area of all region'
- In Shan state, CP varieties were the most commonly cultivated hybrid maize variety, followed by NK and GT respectively.
- In Irrawaddy, CP varieties were spotted as the highest cultivated variety and the second came GT and the last was Pacific varieties
- In Bago regin, CP and NK were broadly cultivated.

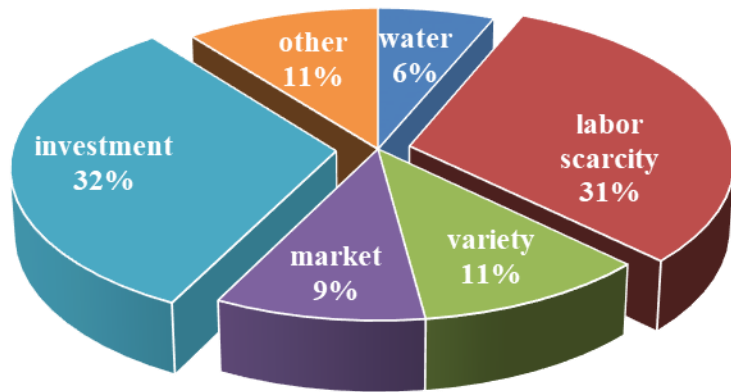
## ➤ Maize grower using different varieties

- The most common maize varieties currently grown in surveying area are hybrid varieties
- USDA report also confirms that (86% in 2017 and 85% in 2018) of maize growers planted hybrid maize seed (USDA; 2018 and Belton;2020).
- Hybrid maize seeds are imported from Thailand, China, and Vietnam-based companies such as CP, Seed Asia, Ayeyarwaddy, and Seven Tiger. (USDA)
- ✓ **This showed that the hybrid maize seed market is dominated by private sector in survey areas**





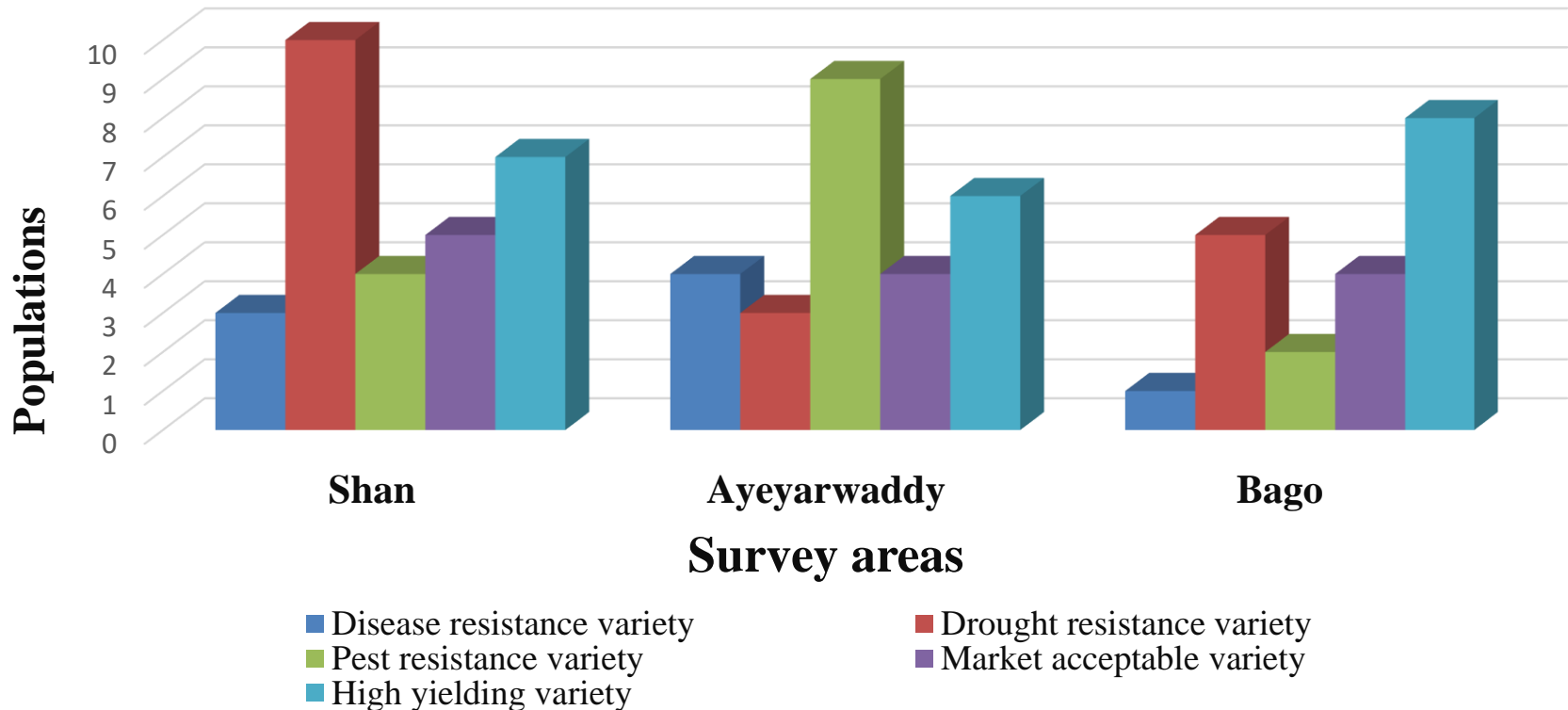
# The constraints of maize grower



**Fig 2. The constraints of maize grower in survey area**

- Constraints varied across the study sites.
- According to the survey data, the constraints in maize production were investment, labor scarcity, demand for improved varieties, water shortage and price fluctuation
- Investment including cost of fertilizer, insecticide/pesticide and labor cost of maize production make up the largest share of production costs in maize farming which account for (32%) of total respondents followed by Labor scarcity (31%), improvement varieties demanded (11%)
- Price fluctuation (9%) of maize grain is also one of the major constraints
- Dawit et al. (2008) found similar constraints in their studies of maize seed systems in the drought prone areas of Ethiopia.

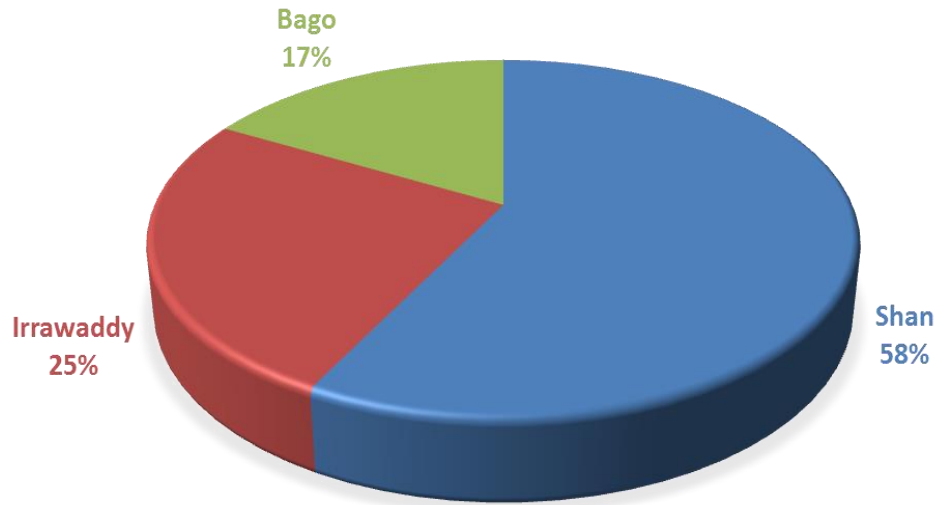
# Farmers' preferences of maize varieties



**Fig 3. Farmers' preference of maize varieties in survey area**

- ✓ Farmers in the surveying areas indicated that the most important preference varieties were high yield, pest resistance, drought resistance, market acceptable and a combination of these.

# Farmer knowledge on GMOs



	Knowledge on GMOs (%)	No knowledge on GMOs (%)
Shan	34	66
Ayeyarwaddy	15	85
Bago	10	90

**Fig 4. Farmer knowledge on GMOs in survey area**

- All of three regions, (34%) farmers in Shan, followed by 15% (Ayeyarwaddy) and 10% in Bago region indicated that they aware of GMO crops (but without proper understanding of the GMO crops)
- In Shan State, knowledge on GMO crop is higher due to the some Agriculture workshop from international organization

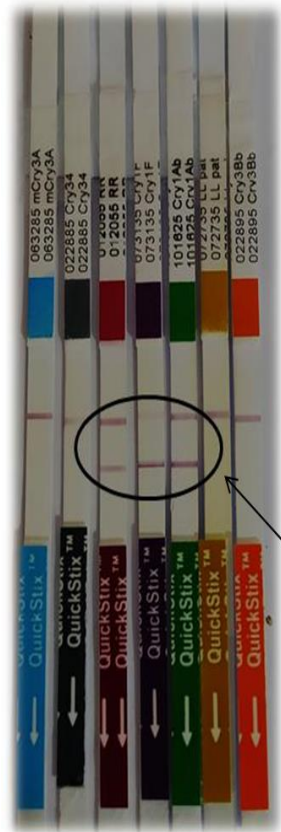


# Laboratory Analysis on GM Contamination



# Detection of GM maize plants

Control  
sample  
Mon 810



Positive

Tested  
Bulk  
sample

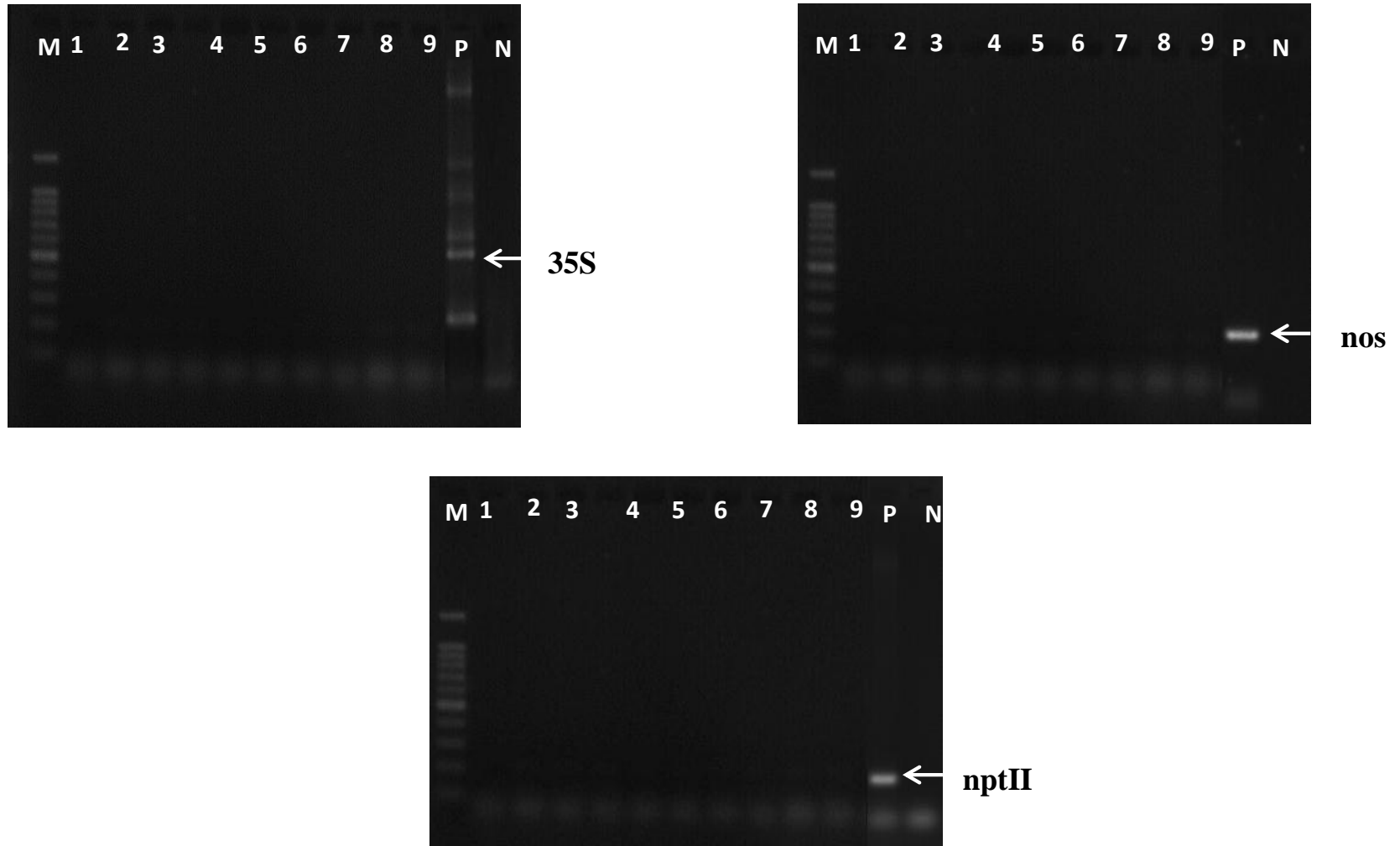


Negative

Fig.5 Detection of maize samples by LFST

- In this study,
- Based on QuickComb (EnviroLogix) maize tests, Cry1Ab, CP 4 EPSPS, Cry 3 Bb, Cry1F, PAT/pat, Cry 34, mCry3A were not express not only in a bulk grain but also in leaves samples.

# Detection of GM maize samples



**Fig 6.** Agarose gel electrophoresis of PCR products from DNA samples collected from maize fields); (A) M, 100-bp DNA ladder; (B) collected samples (lanes 1-9 Lanes) ; (C) P, positive control Mon810; (D) N, negative (no DNA template) control.

# Detection of GM maize plants by PCR

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- PCR analysis is the most widely used method for detecting the presence or absence of transgenes due to its high sensitivity and capacity to discriminate specific transgenic events (García-Cañas, González, & Cifuentes, 2002)
- Based on the PCR analysis,
  - 35S, nos and nptII sequences were not detected in the samples collected from maize-cultivated fields and the brokers' sales center
- ✓ **To date, there are no GM maize varieties are growing in cultivated field in surveying areas. Meaning- Myanmar major maize growing areas were not found the GM contamination.**

# Conclusions

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This survey found that,

- ✓ The hybrid maize seed market is dominated by private sector in Myanmar.
- ✓ Farmers from the surveying area prefer to use the variety which high yielding, resistance to insect pests, drought resistance, market acceptable and a combination of these.
- ✓ Farmers from the surveying area were not aware about genetically modified organism
- ✓ LFST and PCR analysis showed that
- **To date, there are no GM maize varieties are growing in cultivated field in surveying areas.**

# အကြံပြုချက်

- ❖ စစ်တမ်းကောက်ယူခဲ့သောဒေသများရှိ တောင်သူအများစုသည် အထွက်နှုန်းကောင်းမွန်၍ ပိုးမွှားရောဂါနှင့် ရေငတ်ဒဏ်ခံနိုင်ရည်ရှိသော ဈေးကွက်ဝင်ပြောင်းမျိုးများအား လိုလားလျက်ရှိပါသည်။
- ❖ မြန်မာတောင်သူများအနေဖြင့် အိမ်နီးချင်းနိုင်ငံများဖြစ်ကြသော ဖိလစ်ပိုင်နှင့် ဗီယက်နမ် နိုင်ငံတို့မှ ရေငတ်ဒဏ်နှင့် ပိုးမွှားရောဂါဒဏ်ခံနိုင်ရည်ရှိသော အထွက်ကောင်းဗီဇပြုပြင်ပြောင်းသီးနှံများကို နယ်စပ်ဒေသများမှတစ်ဆင့် တရားမဝင် တင်သွင်းလာပြီး စိုက်ပျိုးထုတ်လုပ်လာနိုင်ပါသည်။
- ❖ လက်ရှိအခြေအနေတွင် မြန်မာတောင်သူများသည် ဗီဇပြုပြင်သီးနှံများအား သိရှိနားလည်မှုနှင့် သင့်လျော်သော ဇီဝလုံခြုံမှုဆိုင်ရာနည်းစနစ်များ အားနည်းနေသဖြင့် အခြားသောပြောင်းသီးနှံများနှင့် ရောနှော၍ စိုက်ပျိုးနိုင်ခြင်းကြောင့် ဗီဇပြုပြင်ပြောင်းသီးနှံများ၏ ဝတ်မှုန်များ အလွယ်တကူ ရုတ်တရက် ပျံ့နှံ့လာပြီး မျိုးမသန့်မှုများကို ဖြစ်ပေါ်လာစေနိုင်ပါသည်။
- ❖ ဗီဇပြုပြင်သီးနှံများ မရည်ရွယ်ဘဲပျံ့နှံ့မှုကို ထိန်းချုပ်ရန်နှင့် ဇီဝလုံခြုံမှုဆိုင်ရာ နည်းစနစ်ကောင်းများကို ထူထောင်နိုင်ရန်အတွက် နိုင်ငံအတွင်း ဗီဇပြုပြင်သီးနှံများ စနစ်တကျ စိုက်ပျိုးထားရှိနိုင်မှု အခြေအနေများကို အမြဲမပြတ် စစ်ဆေးရန် လိုအပ်ကြောင်း တင်ပြအပ်ပါသည်။

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