

# Adaptation pattern of introduced biofortified maize varieties in Nepal



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# Outline

- **Background**
  - **Maize**
  - **Malnutrition**
  - **Nepal Seed & Fertilizer project**
- **Field experiments on biofortified maize products**
- **Results & recommendations**



# Background- Maize in Nepal

- Second most important cereal following rice covering 0.9 M ha
- National average yield 2.5 t ha<sup>-1</sup>
- Hills and mid-hills accounts for over 70% of Nepal's maize area
- It is a dietary staple for communities mostly living in the hills (white maize)
- Poultry is the main driver with annual growth rate of 11%
- High market demand for feed (yellow maize)
- Over 100 million USD for import of feed
- The maize seed industry is at nascent stage



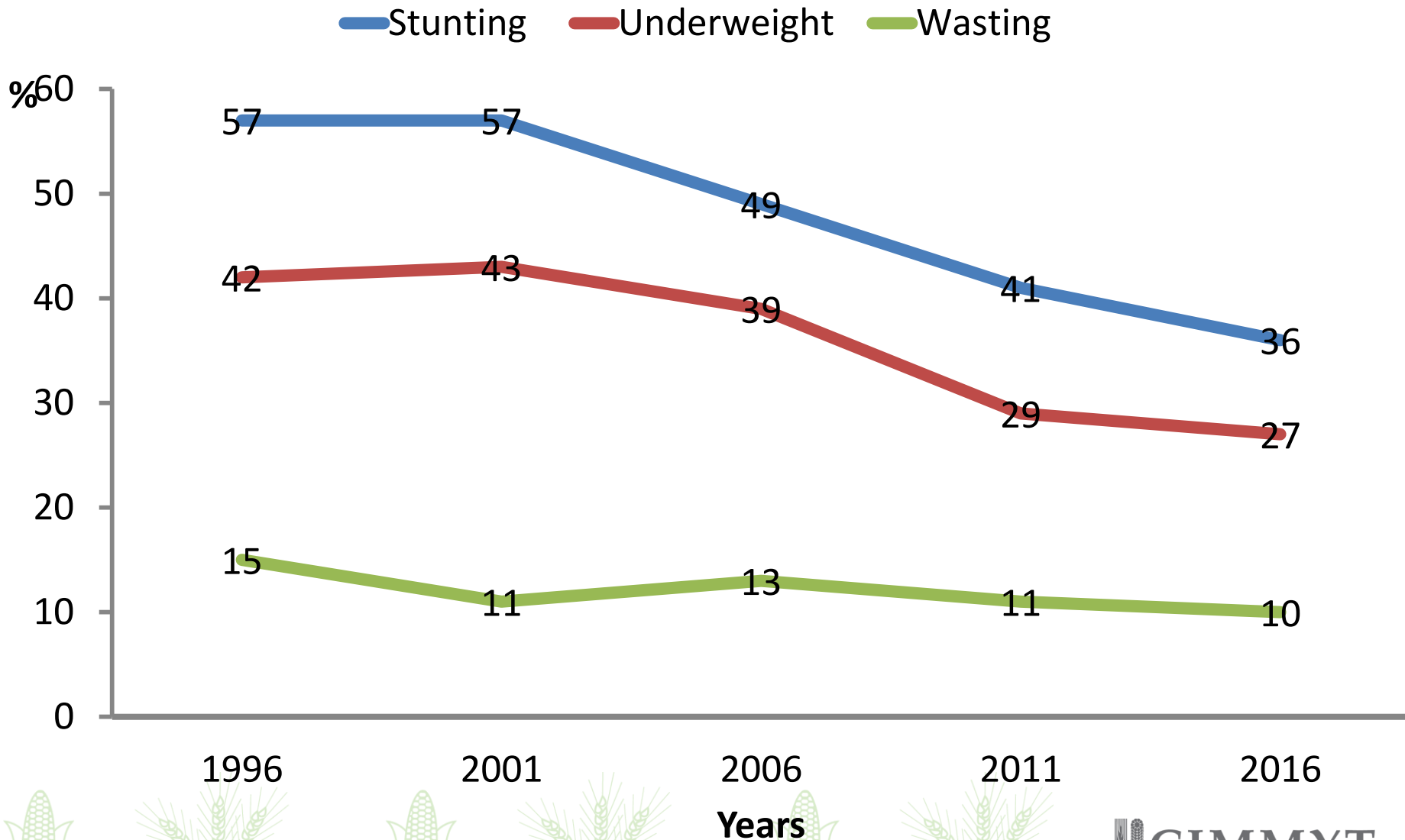
# Background- Status of malnutrition

- Generally in decreasing trend
- However, 1 in 3 children are suffering from stunting
- Despite 60% of household income spent on food
- The rate varies from province to province
- It is more in the hills and mid-hills & with resource poor communities
- It is getting attention due to feminization of Nepal's agriculture
- Fe, Zn and VAD are the major ones

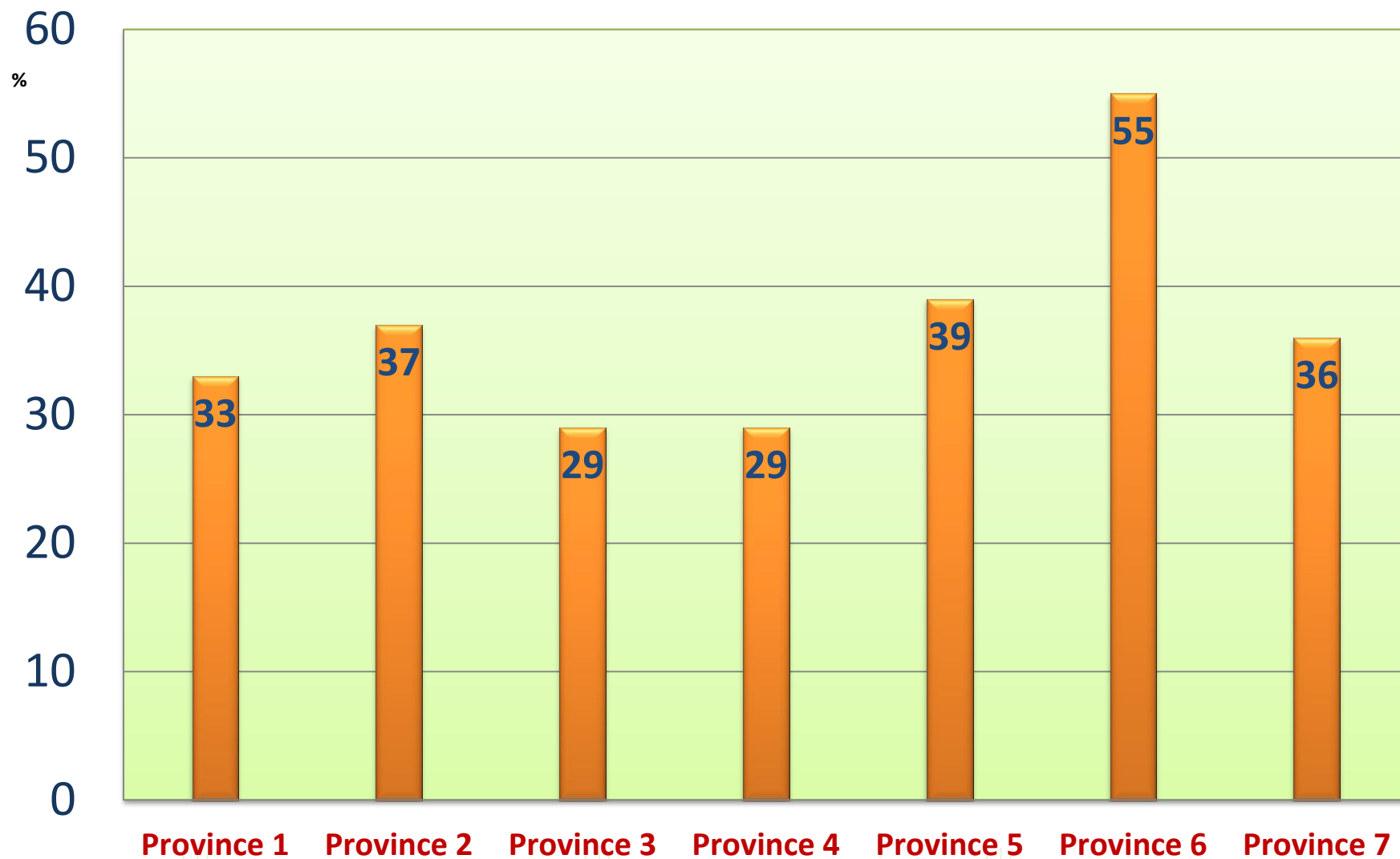


# Trends of children malnutrition in Nepal (%)

(NDHS, 2016)



## Province wise rate of stunting among preschool children (<5 years) in Nepal (NDHS, 2016)



# NEPAL SEED AND FERTILIZER PROJECT

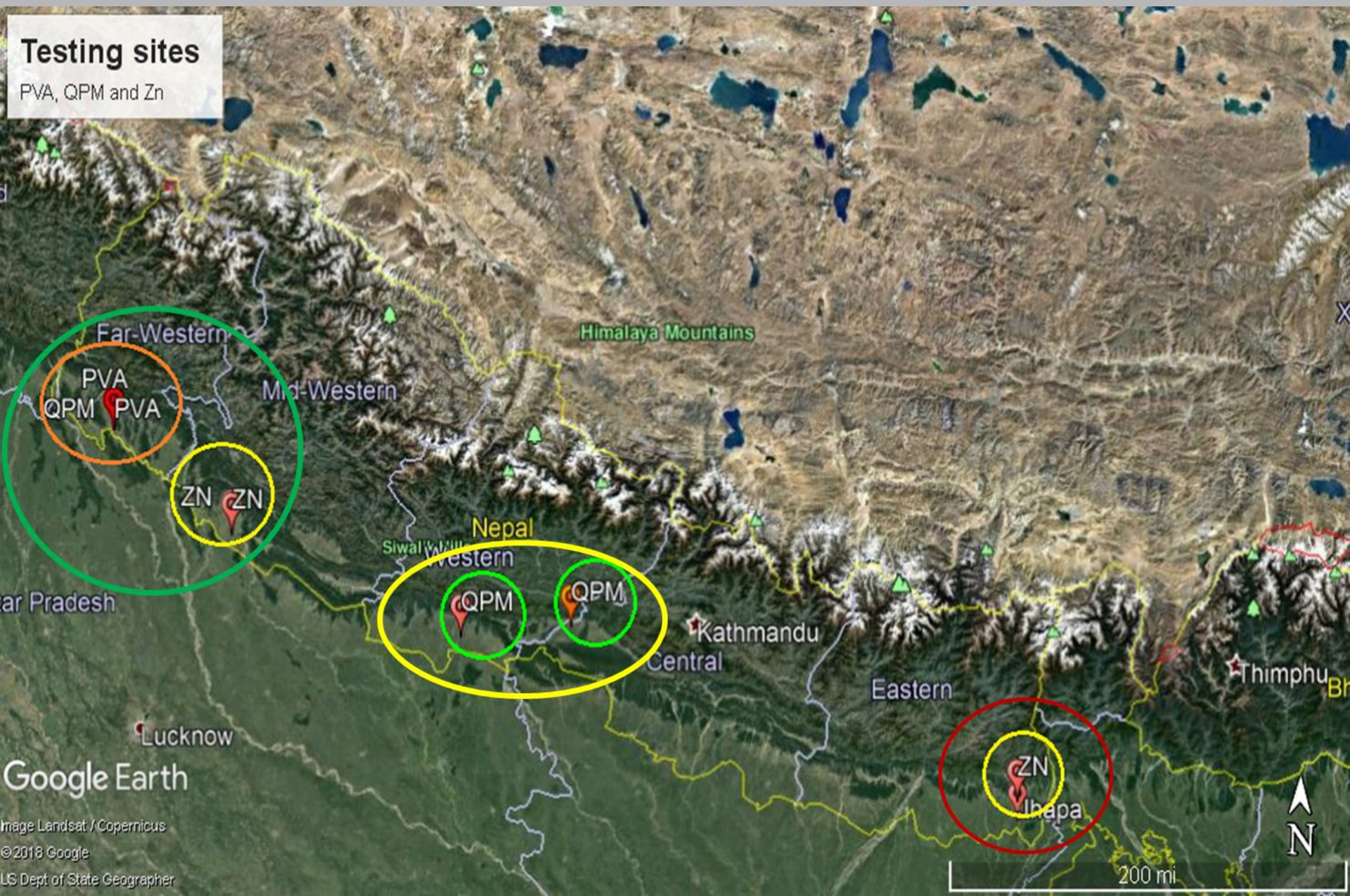
- **USAID's FtF flagship project under the Nepal mission**
- **Rapid diffusion of improved varieties**
- **Introduction/development of biofortified crops**
- **Improved smallholder farmers access to seed and ISFM**
- **In line with GFSS goals:**
  - **Inclusive, agriculture-led economic growth**
  - **Resilience among vulnerable populations**
  - **Improved nutrition**

# Introduction and evaluation of biofortified maize products

<b>QPM</b> (Yellow kernel)				<b>Provitamin A</b> (Orange kernel)		<b>Zn enriched</b> (White kernel)	
<b>Entry no</b>	<b>Entry code</b>	<b>Entry no</b>	<b>Entry code</b>	<b>Entry no</b>	<b>Entry code</b>	<b>Entry no</b>	<b>Entry code</b>
1	SA2282-1	21	SA2283-8	1	EEPVAH-2	1	SA2299-5
2	SA2282-2	22	SA2283-9	2	EEPVAH-3	2	SA2300-1
3	SA2282-3	23	SA2283-10	3	EEPVAH-4	3	SA2299-4
4	SA2282-4	24	SA2283-11	4	EEPVAH-5	4	SA2272-1
5	SA2282-5	25	SA2283-12	5	EEPVAH-7	5	SA2272-2
6	SA2282-6	26	SA2283-13	6	EEPVAH-8	6	SA2291-1
7	SA2282-7	27	SA2283-14	7	EEPVAH-9	7	SA2291-2
8	SA2282-8	28	SA2283-15	8	EEPVAH-10	8	SA2291-3
9	SA2282-9	29	SA2283-16	9	EEPVAH-11	9	Local Check
10	SA2282-10	30	SA2283-17	10	EEPVAH-12		
11	SA2282-11	31	SA2283-18	11	EEPVAH-13		
12	SA2282-12	32	SA2283-20	12	EEPVAH-14		
13	SA2282-13	33	SA2286-1	13	EEPVAH-15		
14	SA2282-14	34	Local Check	14	EEPVAH-24		
15	SA2282-16			15	EEPVAH-25		
16	SA2223-1			16	EEPVAH-26		
17	Local check			17	EEPVAH-27		
18	SA2283-5			18	EEPVAH-28		
19	SA2283-6			19	Local Check		



# Description of the trial sites used for the evaluation of biofortified maize products in Nepal (2017-2018)



Google Earth

Image Landsat / Copernicus  
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US Dept of State Geographer

# Experimental designs and data recording

- Trials were planted in alpha lattice design (QPM and Zn) and RCBD for PVA
- QPM and Zn trials were planted during 2017 winter season (planting in October 2018) and PVA in spring (planting April 2018)
- QPM and Zn trials were introduced from CIMMYT-Latin America breeding hub (Colombia) and PVA from IITA (Ibadan)
- Materials tested both on public and private research stations
- Grain yield was the main trait to be analyzed



# Results and recommendations



# Grain yield performance (t/ha) of Zn enriched maize varieties

Rank	Locations					
	GATE		JAHP		KAJU	
	Entry	Yield	Entry	Yield	Entry	Yield
1	4	10.90	3	6.80	1	7.28
2	9	10.24	1	5.95	2	5.56
3	1	9.98	2	4.45	3	5.37
4	6	9.88	5	4.35	8	5.03
5	3	9.23	7	4.18	6	4.25
6	2	8.93	9	4.12	7	4.10
7	8	8.71	8	4.10	4	3.69
8	5	8.33	6	3.92	5	3.39
9	7	7.51	4	3.85	9	3.06
Mean	9.30		4.63		4.63	
Max	10.90		6.80		7.28	
Min	7.51		3.85		3.06	
LSD <sub>0.05</sub>	3.77		1.38		2.61	
<i>p</i>	ns		*		*	
CV %	16.00		13.00		22.00	

# Grain yield performance (t/ha) of top ten QPM hybrids (out of 34)

Rank	Locations					
	Lumbini		NMRP-R		UNIQUE	
	Entry	Yield	Entry	Yield	Entry	Yield
1	34	14.00	29	8.29	31	11.03
2	18	12.56	16	8.11	27	10.94
3	24	12.51	34	8.04	21	10.48
4	16	12.24	22	8.02	16	10.07
5	6	12.17	31	7.88	32	9.44
6	3	12.14	17	7.27	23	8.81
7	28	11.81	28	7.03	3	8.78
8	30	11.77	5	6.99	28	8.75
9	23	11.72	27	6.91	29	8.58
10	20	11.68	21	6.77	22	8.49
Mean		10.72		5.55		7.25
Max		14.41		8.29		11.03
Min		7.93		2.91		1.83
LSD <sub>0.05</sub>		3.32		2.47		3.97
CV %		15.22		21.83		26.96
<i>p</i>		ns		***		*

# Grain yield performance (t/ha) of top **ten** PVA hybrids (out of 20)

Rank	Locations			
	PANCHASAKHTI		UNIQUE	
	Entry	Yield	Entry	Yield
1	<b>14</b>	<b>6.55</b>	<b>14</b>	<b>9.28</b>
2	<b>20</b>	<b>6.34</b>	<b>7</b>	<b>9.09</b>
3	<b>16</b>	<b>5.57</b>	<b>17</b>	<b>7.17</b>
4	<b>18</b>	<b>5.17</b>	<b>4</b>	<b>6.73</b>
5	<b>13</b>	<b>5.14</b>	<b>9</b>	<b>6.56</b>
6	<b>6</b>	<b>5.13</b>	<b>2</b>	<b>6.48</b>
7	<b>19</b>	<b>5.07</b>	<b>10</b>	<b>6.47</b>
8	<b>10</b>	<b>5.04</b>	<b>16</b>	<b>6.39</b>
9	<b>17</b>	<b>4.96</b>	<b>8</b>	<b>6.18</b>
10	<b>4</b>	<b>4.60</b>	<b>11</b>	<b>6.18</b>
Mean		<b>4.72</b>		<b>6.32</b>
Max		<b>6.55</b>		<b>9.28</b>
Min		<b>3.63</b>		<b>4.36</b>
LSD <sub>0.05</sub>		<b>1.93</b>		<b>4.23</b>
CV %		<b>19.50</b>		<b>31.97</b>

# Recommendations

- **Need to repeat trials for more seasons to check for stability of traits**
- **Fast track variety release and seed production**
- **Promotion of biofortified maize via public private partnership**
- **Integrate with food and nutrition programs and diversify maize based dishes**
- **Enhance capacity in maintaining and monitoring of quality traits**
- **Vibrant seed system to deliver products to farmers**
- **Analyze grain quality against soil quality (Zn trials)**



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**Lumbini Seed Co.**

**All NSAF project staff**





A bunch of colorful corn cobs, including red, yellow, and white varieties, are hanging from a dark, charred husk. The corn is set against a background of cracked, dry earth, suggesting a drought or arid environment. The text "Thank you !" is overlaid in the bottom left corner.

**Thank you !**