World Vegetable Center

Use of World Vegetable Center breeding lines among seed companies in Asia in 2024

This report is an output of the Asia and Pacific Seed Association (APSA) – World Vegetable Center Breeding Consortium. Funding for this research was provided by Consortium Members and long-term strategic donors to the World Vegetable Center: Taiwan, United Kingdom, United States, Australia, Germany, Thailand, Philippines, South Korea, and Japan.

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Cover picture: WorldVeg tomato breeder Assaf Eybishitz, with a participant during the 2024 consortium workshop in Taiwan.
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1. Summary

This new report documents progress of increasing impacts of the Asia and Pacific Seed Association (APSA) – World Vegetable Center Vegetable Breeding Consortium. It includes results of a survey of past and current members, to assess the value of the consortium, the use of WorldVeg germplasm, and to quantify the impacts.

Of all seed companies, 41 responded to the request for data, and combining data with that from previous years, creates a dataset of 61 seed companies. Membership has increased from 19 seed companies in 2017 when it was established, to 58 full members in 2024, including 18 new members in the last year. And of member seed companies, 59% are small and medium sized enterprises with fewer than 100 employees. In 2024, WorldVeg shipped 3,098 seed samples to Consortium members, with bitter gourd and pepper accounting for the bulk of the seed shared. Since 2017, a total of 14,711 seed shipments have been sent out to members.

What was clear is that a growing number of seed companies are using WorldVeg germplasm of pepper, tomato, bitter gourd and pumpkin, in their breeding programs, and that some have also started using loofah germplasm. The number of vegetable varieties on the market containing WorldVeg-developed germplasm increased from 47 varieties in 2017, to a significant 193 in 2024. Seed sales of WorldVeg-related varieties have also grown exponentially from 50 tonnes in 2022, to 64 tonnes in 2023, and 83 tonnes in 2024. This volume of seed is enough to plant an estimated 316,300 hectares and reach 829,700 farm households.

Begomovirus resistance is stated as the most desired trait for all five crops, along with higher yields. Other important traits include resistance to powdery mildew for bitter gourd, pumpkin and loofah, is bacterial wilt resistance for tomato, anthracnose resistance for pepper, and tolerance against high temperatures for pepper and tomato.

Overall, the results of this study evidently show that the Asia and Pacific Seed Association (APSA) – World Vegetable Center Vegetable Breeding Consortium is enabling greater use of WorldVeg enhanced germplasm across Asia's seed sector, thus increasing the benefits of smallholder vegetable farmers across the continent.

1 Consortium membership

Established in 2017, the Asia and Pacific Seed Association (APSA) – World Vegetable Center Vegetable Breeding Consortium aims to increase the impact of WorldVeg vegetable breeding on smallholder farmers in Asia. The Consortium had 58 members in 2024, up from 51 members in 2023 and 40 members in 2022 (Figure 1).

Of seed companies, 18 joined the Consortium for the first time in 2024 (Annex Table A1). Most of these companies joined the Consortium to participate in one of the three special projects launched in 2024. Sixteen companies left the Consortium in 2024. Five were one-time members in 2023, but the other 11 are long-term members likely to join again in the future.

In 2024, 53 of the 58 Consortium members were based in Asia (91%). Regarding countries, 31 (53%) came from India, seven from Taiwan, three from Japan, and three from Thailand (Table 1). Membership is divided into small/start-up and medium/large companies, with the threshold being 100 employees. The share of small companies was 59%, the first time in the Consortium's history that there were more small than large companies (Figure 2).

One of the benefits of Consortium membership is the possibility of joining special projects. The Consortium launched eight special projects, with a ninth project set to start in March 2024 (Table 2). The fourth phase of the bitter gourd project, which began in February 2023, attracted strong interest. Thirty-five seed companies joined, the maximum set when the project was announced.

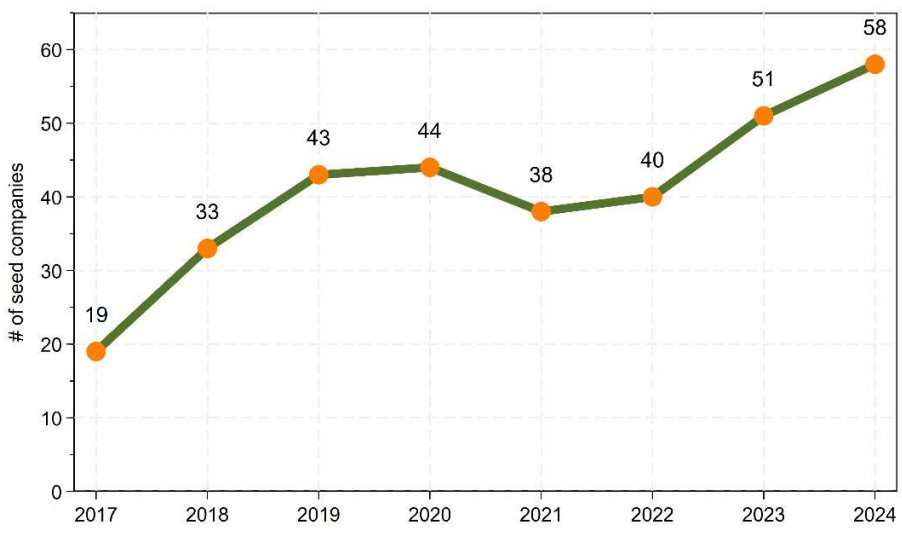

Figure 1 Consortium membership 2017-2024

Table 1 Distribution of Consortium members by registered location and year

	2017	2018	2019	2020	2021	2022	2023	2024
Asia:								
– China	0	0	3	0	0	0	0	0
– Hong Kong, China	1	1	1	1	1	1	1	1
– India	13	23	24	25	22	20	30	30
– Indonesia	2	2	2	1	2	3	2	2
– Japan	1	4	3	3	1	3	2	3
– Malaysia	0	0	0	0	1	1	1	2
– Pakistan	0	0	2	2	1	2	3	2
– Philippines	0	0	0	0	0	0	0	1
– Saudi Arabia	0	0	0	0	0	0	1	0
– South Korea	0	0	0	0	1	1	0	0
– Sri Lanka	0	0	1	2	2	0	1	1
– Taiwan	0	1	3	3	2	2	3	7
– Thailand	1	1	2	4	2	3	4	3
– Turkey	0	0	0	0	0	0	0	1
– Viet Nam	0	0	0	1	0	0	0	0
Outside Asia:								
– Brazil	0	0	1	0	1	1	1	1
– France	0	0	0	0	1	1	1	0
– Netherlands	1	1	1	1	1	1	1	1
– South Africa	0	0	0	0	0	1	0	1
– Spain	0	0	0	0	0	0	0	1
– USA	0	0	0	1	0	0	0	1

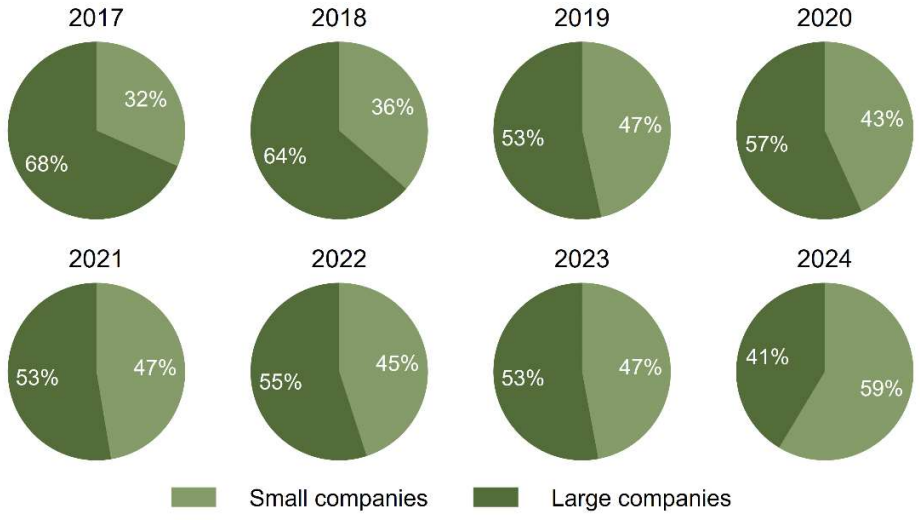

Figure 2 Composition of the Consortium in terms of small vs. large companies

Table 2. Special projects launched under the Consortium

Project names [a]	Project period	No. of participating seed companies
1. 1st Bitter gourd	4/2016-3/2019	4
2. 2nd Bitter gourd	4/2017-3/2020	10
3. 3rd Bitter gourd	4/2019-3/2022	12
4. 4th Bitter gourd	2/2023-1/2025	35
5. Pumpkin	7/2020-6/2023	11
6. ChiVMV	7/2020-6/2023[b]	8
7. ChiLCD	7/2020-6/2024[b]	17
8. HST of Tomato and Pepper	8/2021-7/2024	14
9. Loofah project	3/2024-2/2026[c]	27
10. Tomato hybrids	9/2024-8/2026	7
11. Chilli thrips	9/2024-8/2029	10
12. Okra	2/2025-1/2027	40

[a] Project full names:

- 1st bitter gourd project: Private seed sectors support to AVRDC's global cucurbit breeding program;
- 2nd bitter gourd project: Broadening the narrow genetic base of commercial bitter gourd cultivars by exploiting the genetic diversity of WorldVeg's breeding lines;
- 3rd bitter gourd project: Genetically diverse and superior bitter gourd lines and F1 hybrids of World Vegetable Center for sustainable bitter gourd breeding gains and enhanced profitability of smallholder farmers.
- 4th bitter gourd project: Growing new markets with better bitter gourd genetics: WorldVeg's monoecious, gynoecious and predominantly female lines of different market segments developed through recurrent selection to breed breakthrough hybrids.
- Pumpkin project: Genetically diverse and superior World Vegetable Center tropical pumpkin lines and F1 hybrids for sustainable pumpkin breeding gains and enhanced profitability of smallholder farmers;
- ChiVMV project: Multi-location evaluation of chili lines carrying different combinations of pvr and Cvr genes for resistance to *Chili veinal mottle virus;*
- ChiLCD project: Chili leaf curl disease in Asia: Diversity and resistance;
- HST of Tomato and Pepper project: Heat stress tolerance of tomato and pepper.
- Loofah project: Creating sustainable markets with solid loofah genetics: WorldVeg leaf curl virus and downy mildew-resistant lines of different market segments essential to develop breakthrough hybrids;
- Okra project: Developing new markets with better okra genetics: WorldVeg begomovirus-resistant lines with improved horticultural traits to breed breakthrough F1 hybrids. [b] Project periods amended because of delays in conducting the trials related to COVID-19 and seed shipments. [C] Project launched in August 2023 and started in March 2024.

2 Seed shipments

Consortium members can order Consortium exclusive lines as well as any other (non-exclusive) lines or genebank accessions. Figure 3 shows the number of seed shipments processed by WorldVeg per year. In 2024, WorldVeg shipped 3,098 seed samples to Consortium members. Bitter gourd and pepper accounted for the lion's share of this. Since 2017, a total of 14,711 seed shipments have been sent. The geographical distribution of the seed shipments shows that 61% were sent to companies in South Asia, 32% to East and Southeast Asia, and 7% to companies with a registration address outside Asia (Table 3).

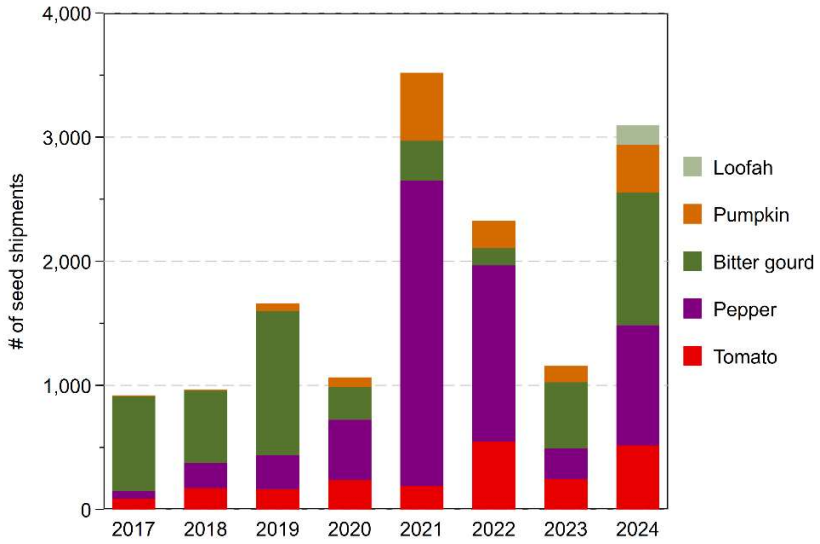

Figure 3 Germplasm shipments to past and current Consortium members, 2017-2024

Table 3 Distribution of germplasm shipments by region, sum of shipments over 2017-2024

Region	Tomato	Pepper	Bitter gourd	Pumpkin	Loofah	Total
South Asia	1,046	3,497	3,750	697	42	9,032
East and Southeast Asia	817	2,016	998	741	120	4,692
Rest of the world	300	602	81	4	-	987
Total	2,163	6,115	4,829	1,442	162	14,711

3 Data collection from Consortium members

This study aims to track seed companies' use of WorldVeg-developed breeding lines and hybrids of tomato, pepper, bitter gourd, and tropical pumpkin in Asia and estimate their use by farmers. Loofah was added in 2023 to provide a baseline to measure future impact. The key performance indicators for the Consortium are:

(1) Number of seed companies using WorldVeg-developed breeding lines in their breeding programs
(2) Number of varieties currently sold in Asia that contain WorldVeg-developed breeding lines
(3) Quantity of seed of varieties containing WorldVeg-developed germplasm sold in Asia
(4) Area potentially planted WorldVeg-related varieties (calculated using Indicator 3 and an average seed rate)
(5) Number of farms potentially reached (calculated using Indicator 4 and average planted area per farmer)

A second objective of the study is to identify the breeding priorities of Consortium members to inform WorldVeg breeding programs. This was recorded using a standard list of traits updated annually by WorldVeg breeders.

Data were collected by email using a standard Excel data entry sheet sent to the voting representative and registered contact person of current and past Consortium members. No major changes were made to the data collection method used in the past, but we collected additional information on market types of bitter gourd, loofah, and pumpkin.

Table 4 Questionnaire response per year

Year	Companies that provided data
2017	14
2018	11
2019[a]	4
2020	23
2021	36
2022	41
2023	35
2024	41
Any year	61

Note: [a] No survey was conducted in 2019.

The email request was sent to 81 companies at the end of March 2025 and asked them to return the data sheets within two weeks. We received data from 41 seed companies (Table 4) by the end of April 2025. In total, 61 seed companies have provided data at any time since 2017—62% of all past and present members (98 seed companies). Of the 2024 Consortium members, 20 never provided data. Some respondents provided data for earlier years, creating additional data points. However, not every company has provided data for every year, which makes it difficult to identify trends. Therefore, we replaced missing data with the most recent non-missing data. So, if a company did not provide data for 2024, we replaced it with data provided for 2023, or else with data for 2022 or earlier. Combining these data points allows us to estimate the impact for 2024 based on data for 61 companies and estimate a trend since 2017.

4 Use of WorldVeg germplasm in breeding

Figure 4 shows the number of seed companies using WorldVeg lines in their vegetable breeding programs or have already incorporated WorldVeg genetics in their commercial varieties. The data show a steady increase in the use of WorldVeg breeding lines in company breeding programs and in varieties resulting from these programs. Key traits used in breeding programs and derived from WorldVeg germplasm are shown in Figure 5. For tomatoes, begomovirus resistance and bacterial wilt resistance are clearly the most widely used traits with over half of all seed companies with tomato breeding programs using these. Heat tolerance and late blight resistance are other widely used traits based on WorldVeg germplasm. There are no such widely used traits for pepper, but heat tolerance and cytoplasmic male sterility (CMS) are used by about 31% of companies engaged in pepper breeding. For bitter gourd, the three most popular WorldVeg traits are begomovirus resistance (used by 53% of companies), high female/male flower ratio (46%), powdery mildew resistance (43%), and fruit color (43%). Finally, for pumpkin, WorldVeg material appears widely used for horticultural traits such as flesh color, flesh thickness, skin color, taste, and fruit shape.

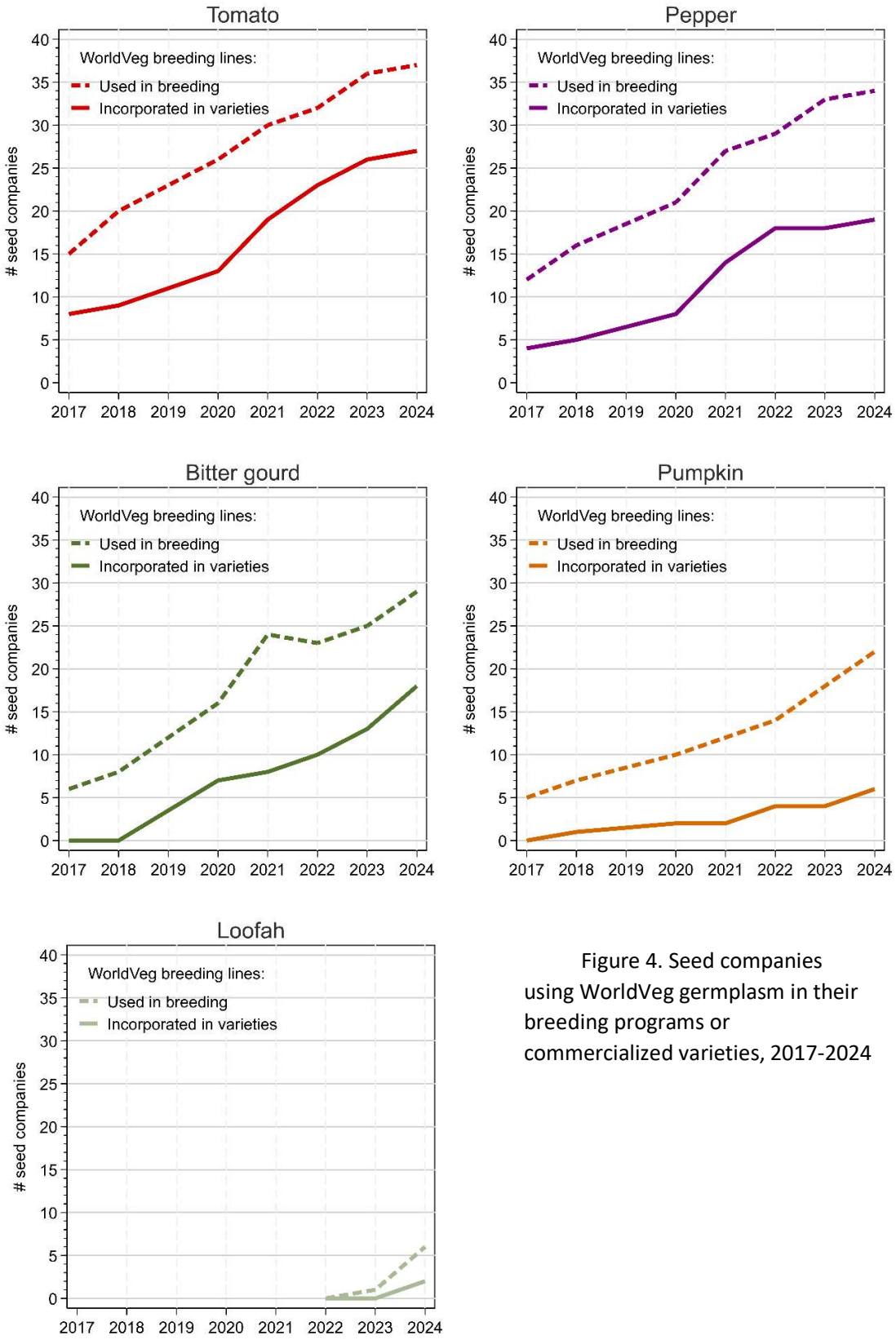

Figure 4. Seed companies using WorldVeg germplasm in their breeding programs or commercialized varieties, 2017-2024

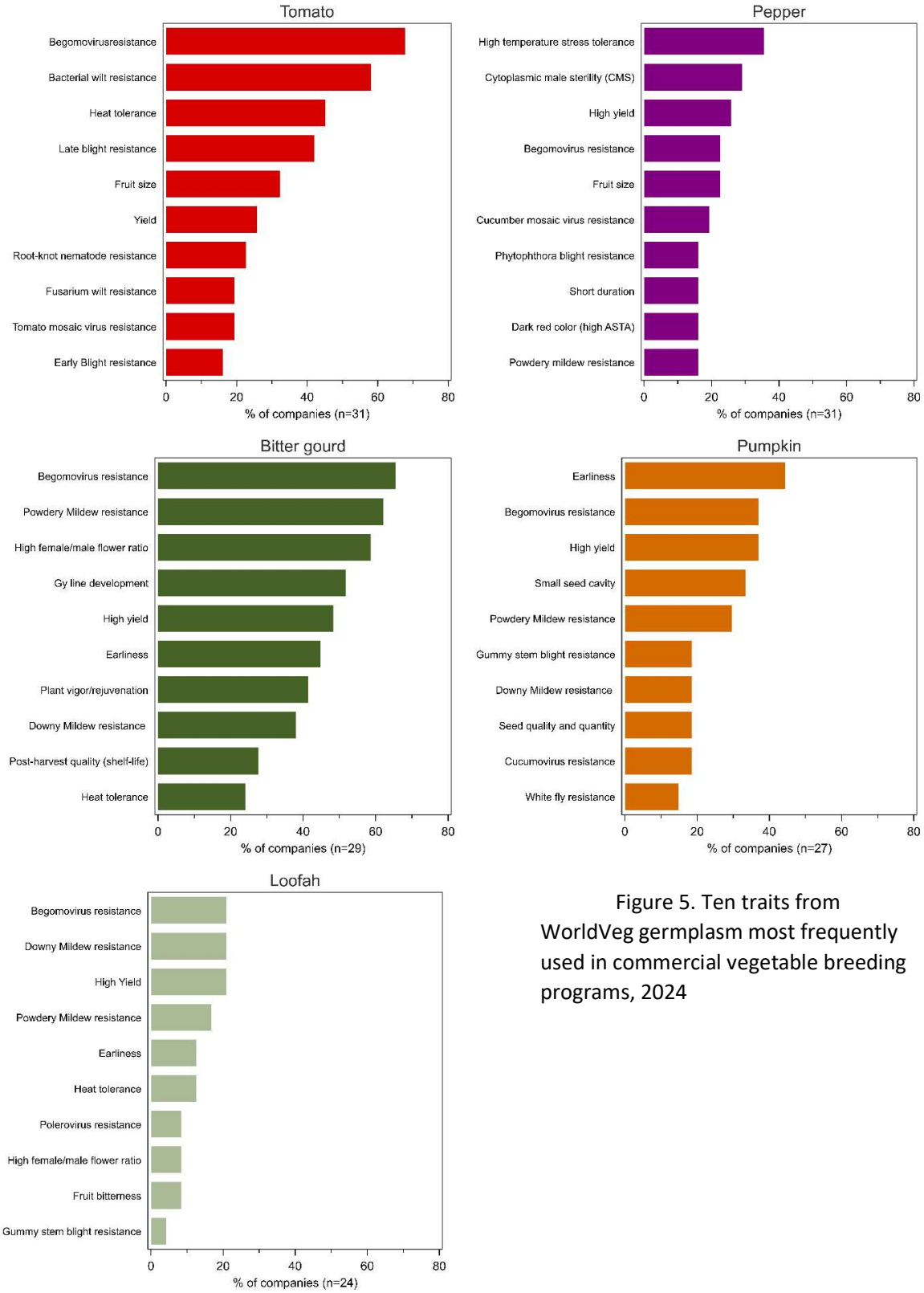

Figure 5. Ten traits from WorldVeg germplasm most frequently used in commercial vegetable breeding programs, 2024

5 Key performance indicators

All crops

The number of vegetable varieties on the market containing WorldVeg-developed germplasm continuously increased from 47 varieties in 2017 to 193 in 2024 (Figure 6). Seed sales of these varieties increased from 24.6 tonnes in 2017 to 83.4 tonnes in 2024 (Figure 7). This volume is enough to potentially plant 316,300 hectares under Consortium crops (Figure 8) and to reach 829,700 farm households (Figure 9).

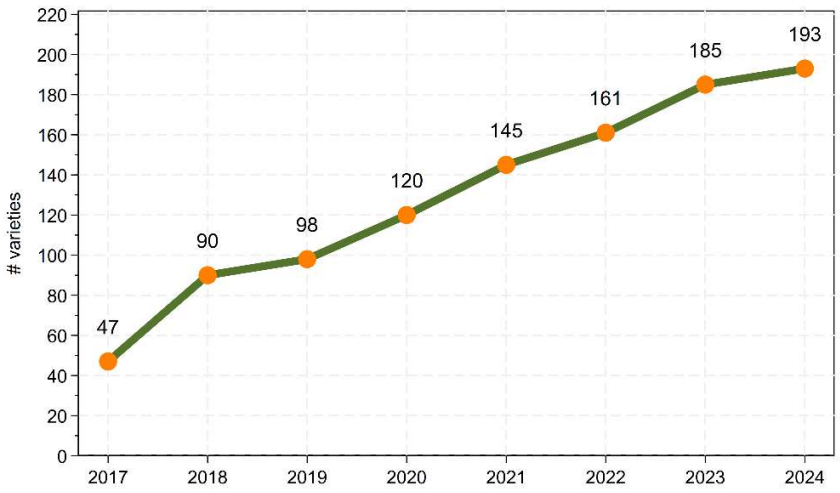

Figure 6 Vegetable varieties sold in Asia containing WorldVeg-developed germplasm, 2017-2024

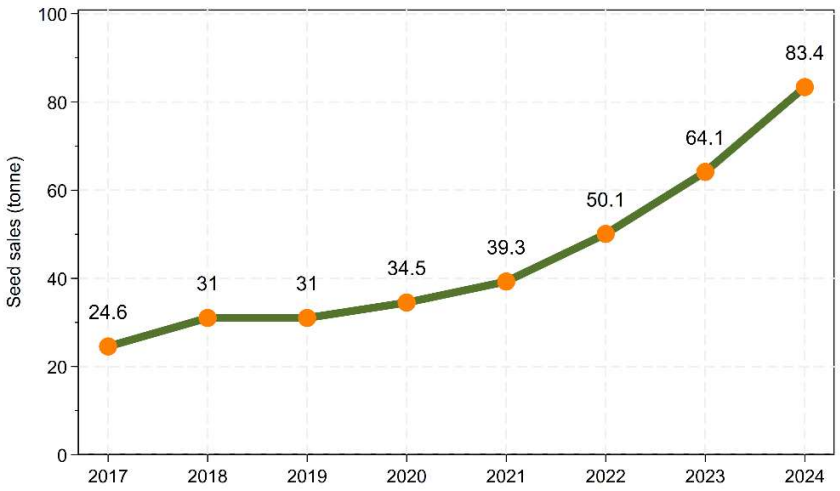

Figure 7 Asian seed sales of vegetable varieties containing WorldVeg germplasm, 2017-2024

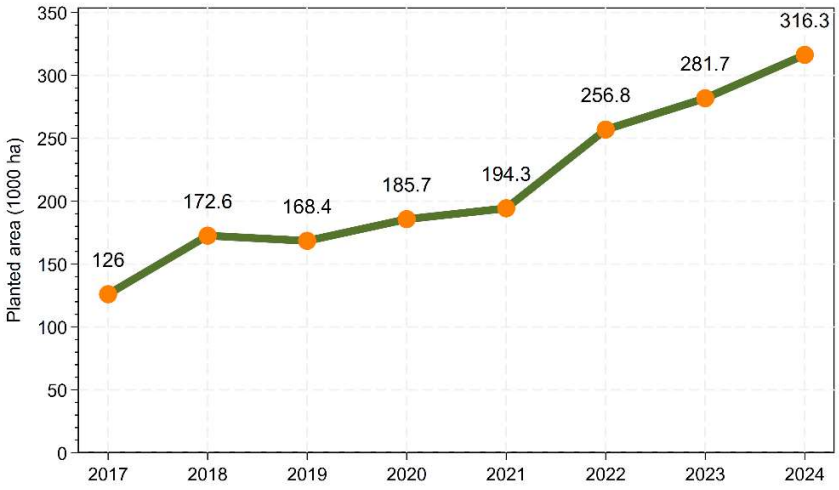

Figure 8. Planted area in Asia under vegetable varieties containing WorldVeg germplasm, 2017-2024

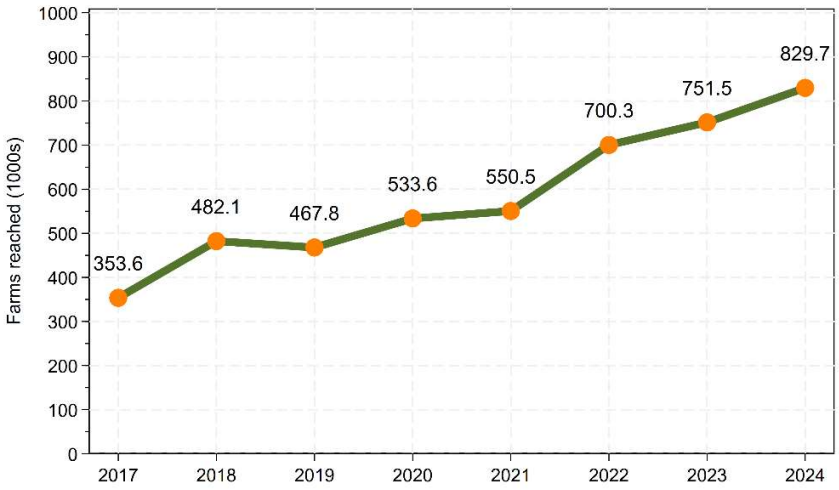

Figure 9. Farms reached in Asia with vegetable varieties containing WorldVeg germplasm, 2017-2024

Tomato

Tomato breeding is one of the longest-standing vegetable breeding programs at WorldVeg. Hence, the impact of this program was already substantial before the start of the Consortium in 2017. The number of commercial tomato varieties based on WorldVeg germplasm has steadily increased from 30 in 2017 to 80 in 2024 (Figure 10). Seed sales have hovered around 15 tonnes per year since 2020 and were 15.8 tonnes in 2024. This seed volume is enough to plant 131,500 ha of tomatoes and reach about 424,000 smallholder farms in Asia.

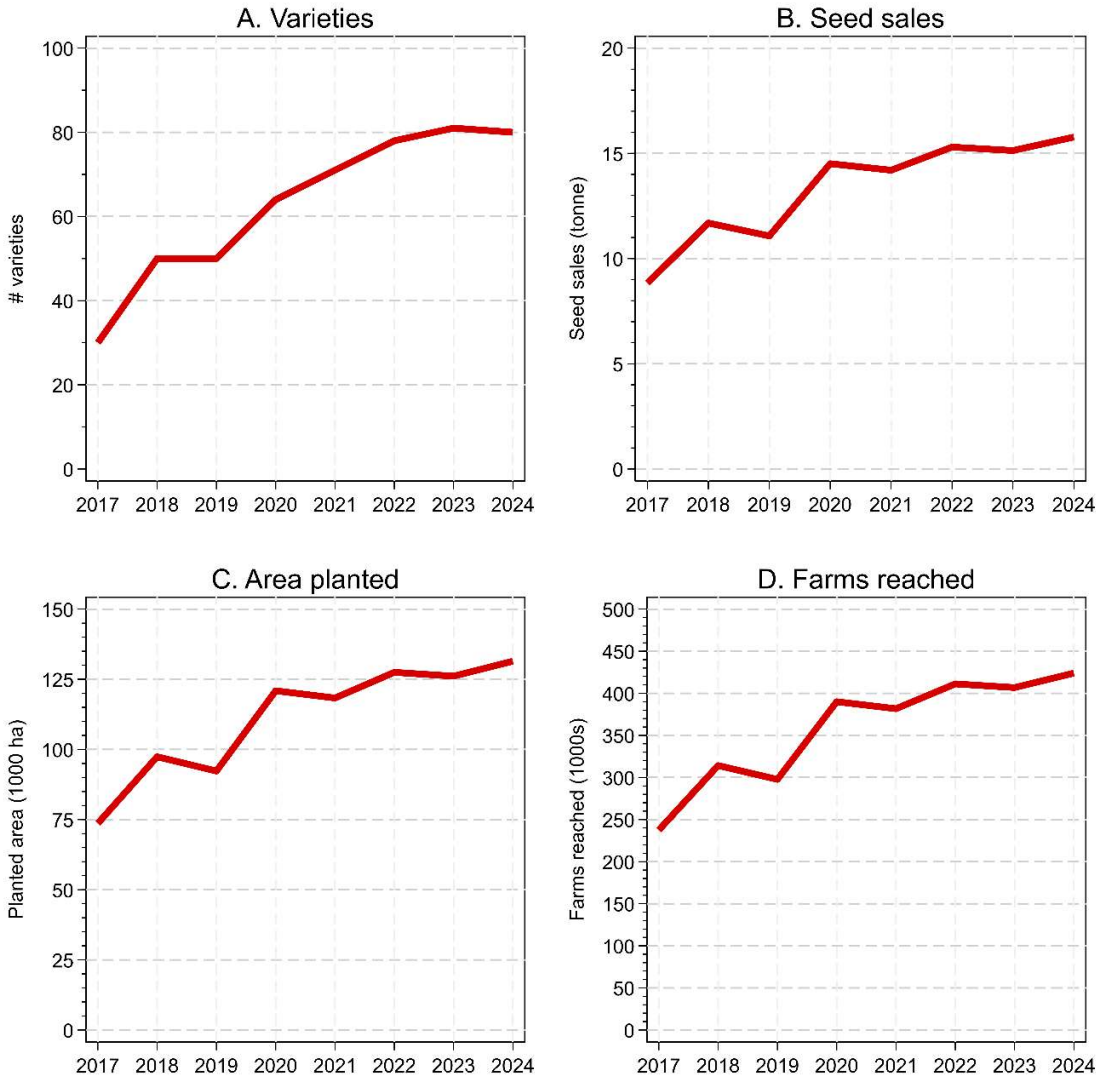

Figure 10. Impact of WorldVeg tomato breeding, 2017-2024

Pepper

WorldVeg pepper breeding started in 1984. The number of commercial pepper varieties based on WorldVeg germplasm has steadily increased from 17 in 2017 to 53 in 2023 and 2024 (Figure 11). Seed sales were 19.2 tonnes in 2024. This seed volume is enough to plant 128,100 ha of peppers and reach about 291,100 smallholder vegetable farms in Asia.

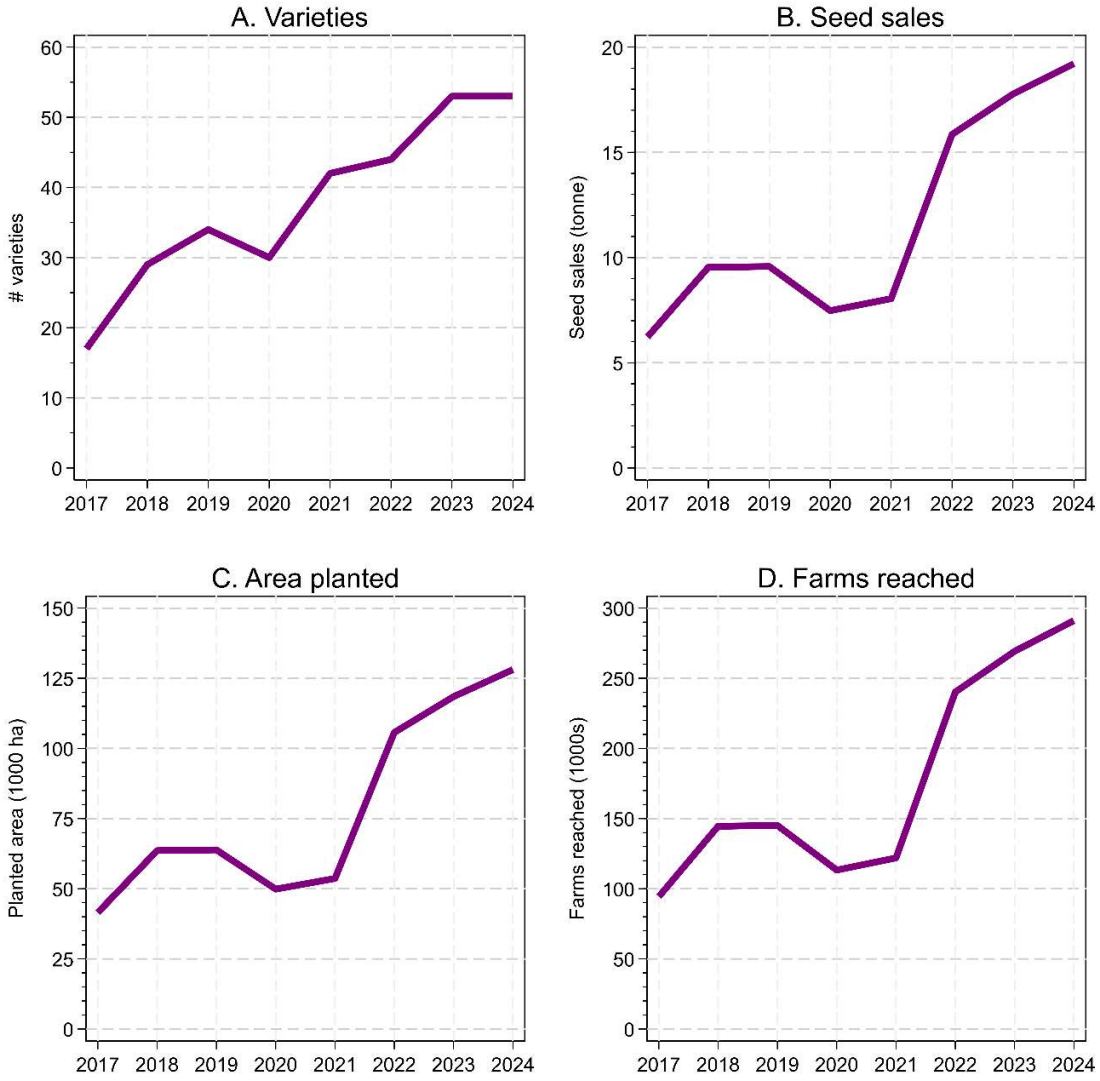

Figure 11. Impact of WorldVeg pepper breeding, 2017-2024

Bitter gourd

Bitter gourd is a clear success story of the Consortium. The number of commercial bitter gourd varieties based on WorldVeg genetics has increased every year from 0 in 2017 to 53 in 2024 (Figure 12). Seed sales were 47.7 tonnes in 2024—enough to plant 54,500 ha and reach 109,100 farms in Asia.

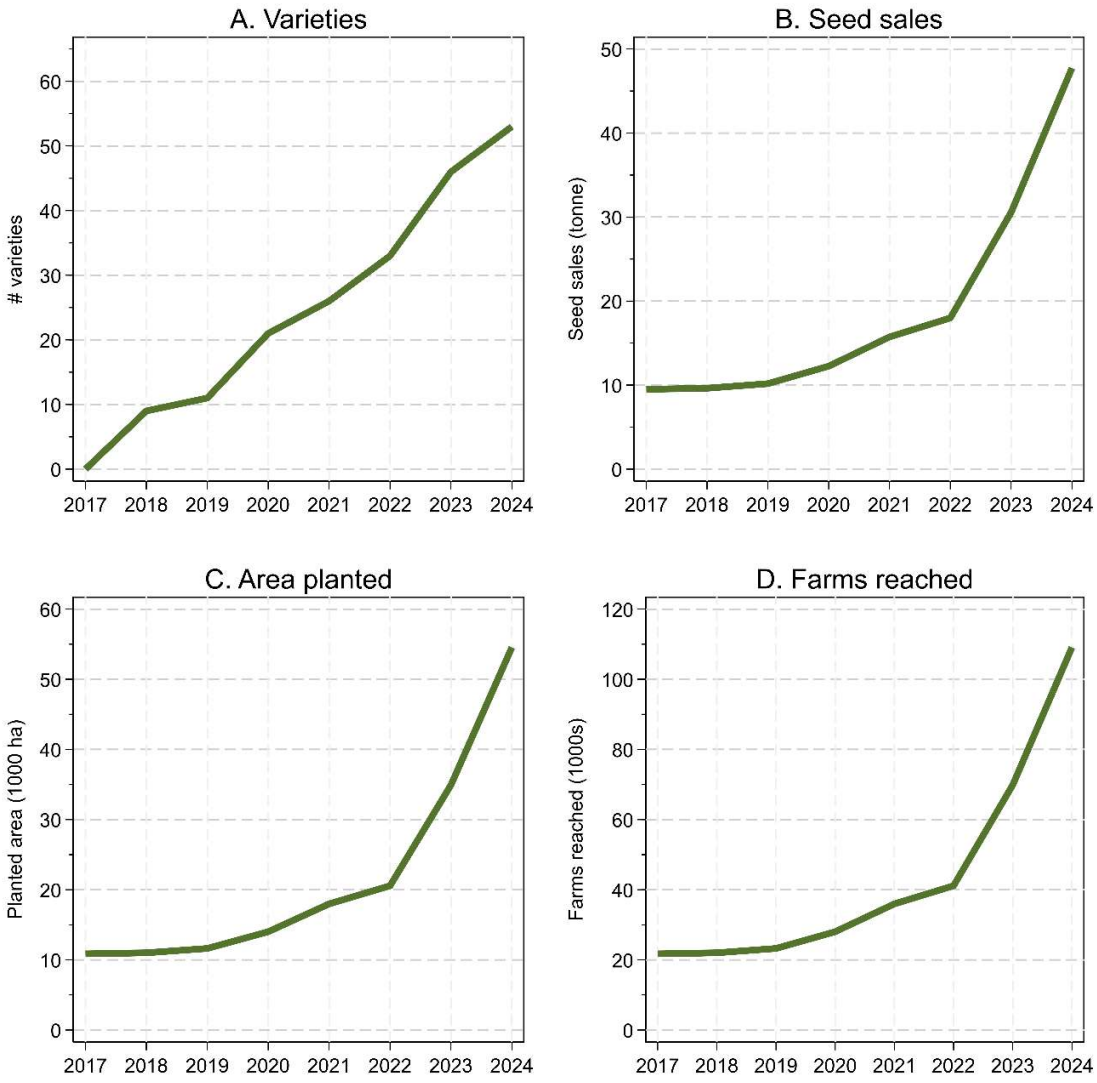

Figure 12. Impact of WorldVeg bitter gourd breeding, 2017-2024

Pumpkin

WorldVeg breeding of tropical pumpkin started in 2006 and is one of the youngest programs. Impact currently relies on a small group of seed companies although 22 companies reported to use WorldVeg pumpkin germplasm in their breeding. Our data show 7 commercial pumpkin varieties sold in Asia based on WorldVeg germplasm and seed sales of about 0.65 tonnes—enough to plant 2,200 ha and reach 5,400 smallholder farmers (Figure 13).

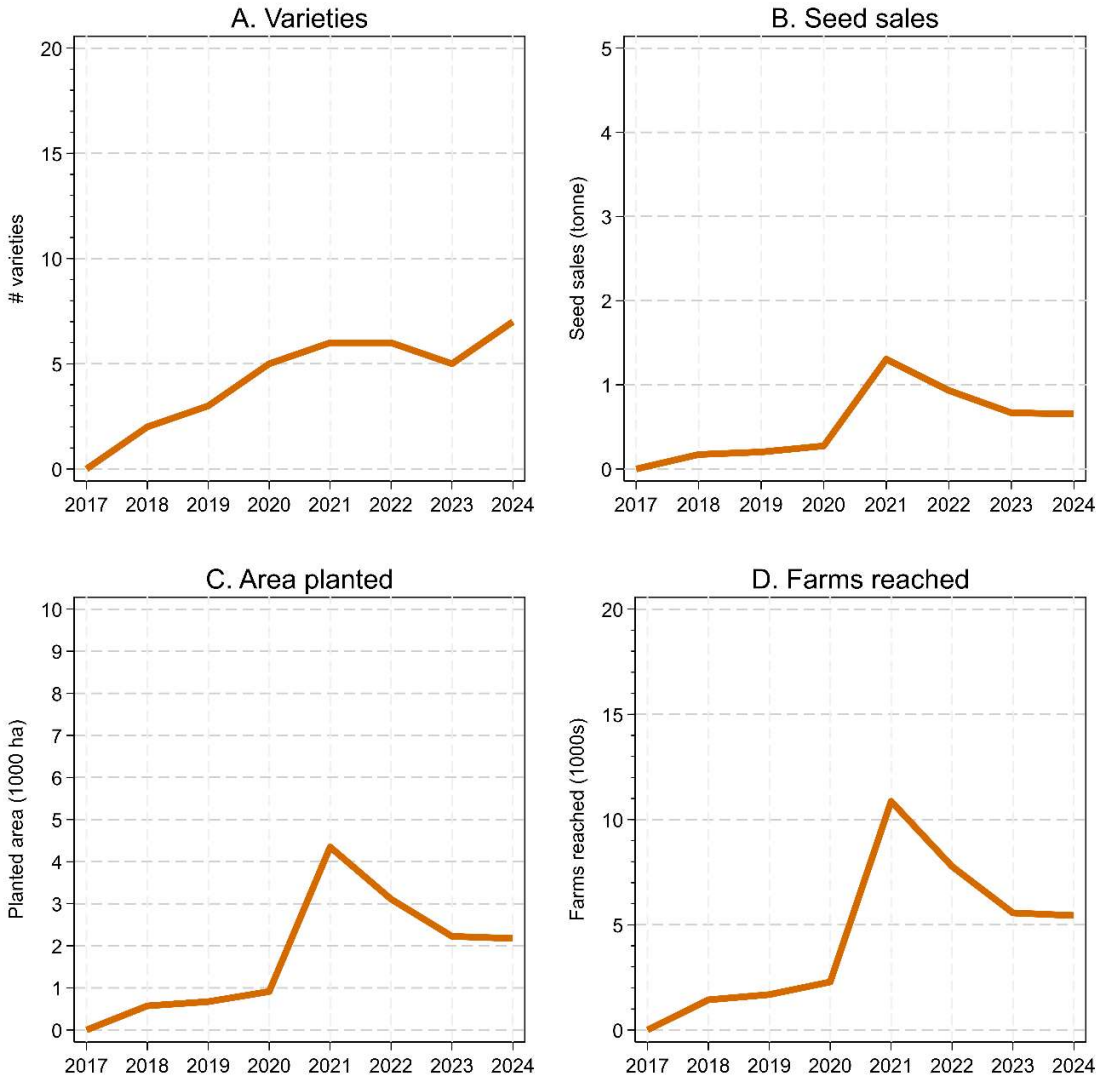

Figure 13. Impact of WorldVeg pumpkin breeding, 2017-2024

Loofah

WorldVeg loofah breeding started in 2021 and is the youngest program. No commercial loofah varieties have been released to date (Figure 14).

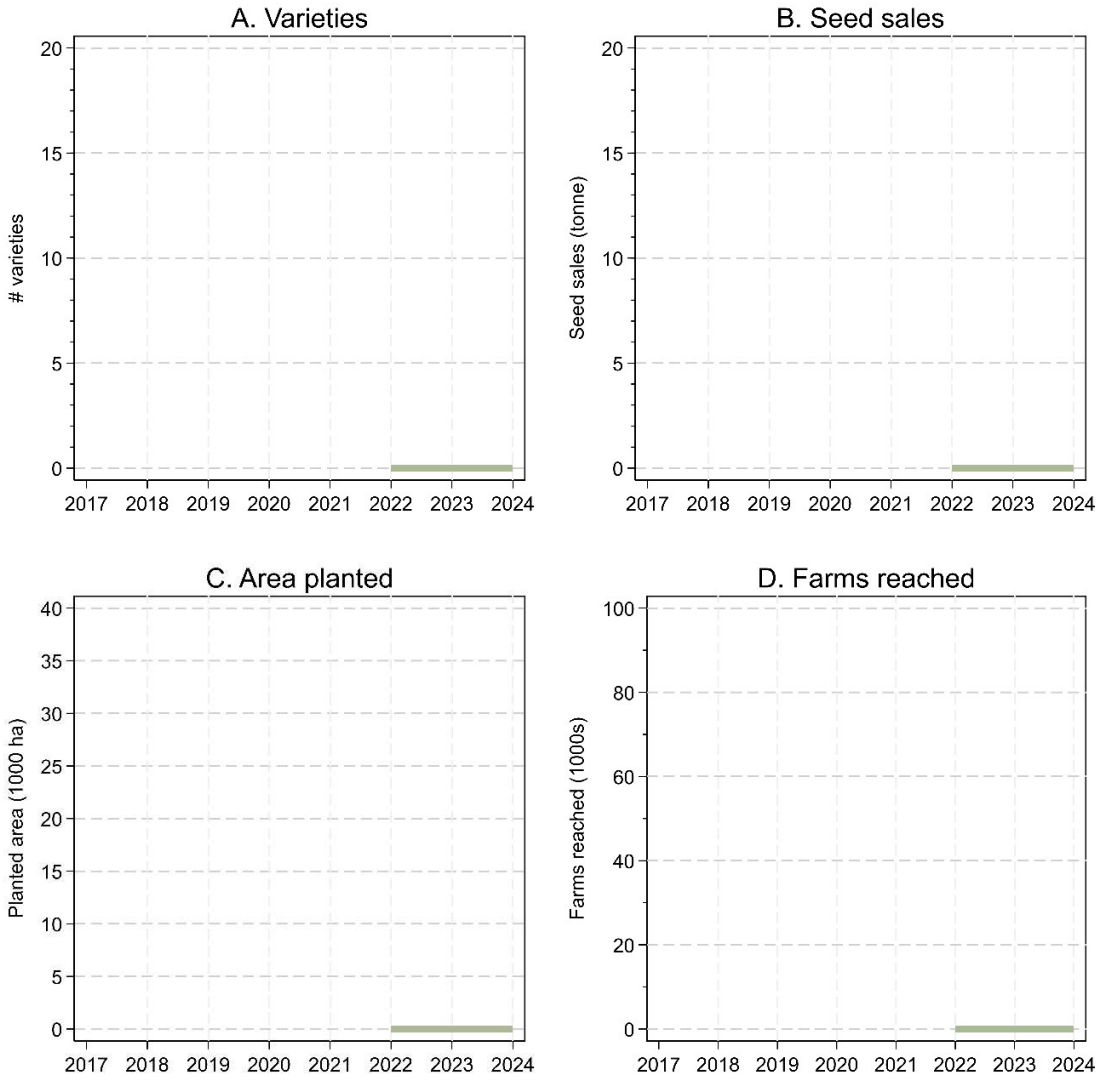

Figure 14. Impact of WorldVeg loofah breeding, 2017-2024

6 Market types

WorldVeg breeding lines can be turned into commercial varieties more quickly if their horticultural characteristics match market types. While WorldVeg breeders have a sound understanding of market types in different regions, we do not have systematic data on these. In the 2025 survey, we asked seed companies to inform us of their key market types for cucurbit crops and tomatoes. The results are summarized by crop. It was not possible to identify regional differences from the data because seed companies sell seed in different markets. It was also not possible to estimate the size of each segment, as we did not ask for seed sales per segment.

Bitter gourd

Seed companies reported about 72 market types of bitter gourd. Of these, 56% were dark green fruit, 28% were green fruits, and 17% were white fruits (Figure 15). Regarding skin pattern, 46% of market types were spiny, 24% had blunt ends, and 30% had continuous ridges. In terms of taste, 54% were bitter and 46% were non-bitter.

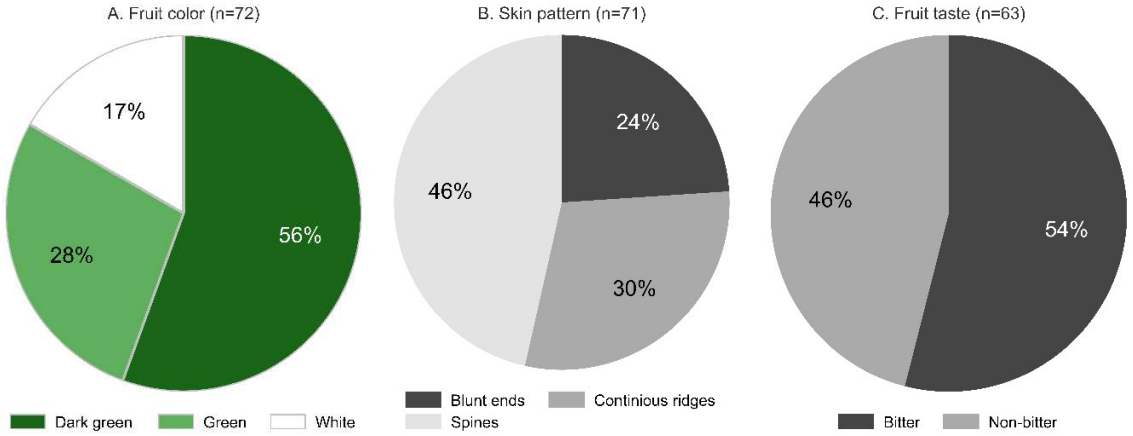

Figure 15. Bitter gourd market types, 2025

Pumpkin

Seed companies reported about 50 market types of pumpkin. Market types of pumpkin are diverse with differences in skin color, flesh color, fruit size, fruit skin pattern, taste, and flesh thickness as defining characteristics (Figure 16). In terms of fruit flesh color, 34% of the segments are yellow and 66% are orange. Fruit skin color is very diverse, but mottle green and dark green are the main types. Pumpkin size was differentiated into three sizes: 1.5kg (28% of market types), 1.5-5 kg (53%), and above 5 kg (18%). In terms of fruit shapes, the flat-round type dominates (56%). Most seed companies preferred sweet varieties (82% of market types) with thick flesh (84%).

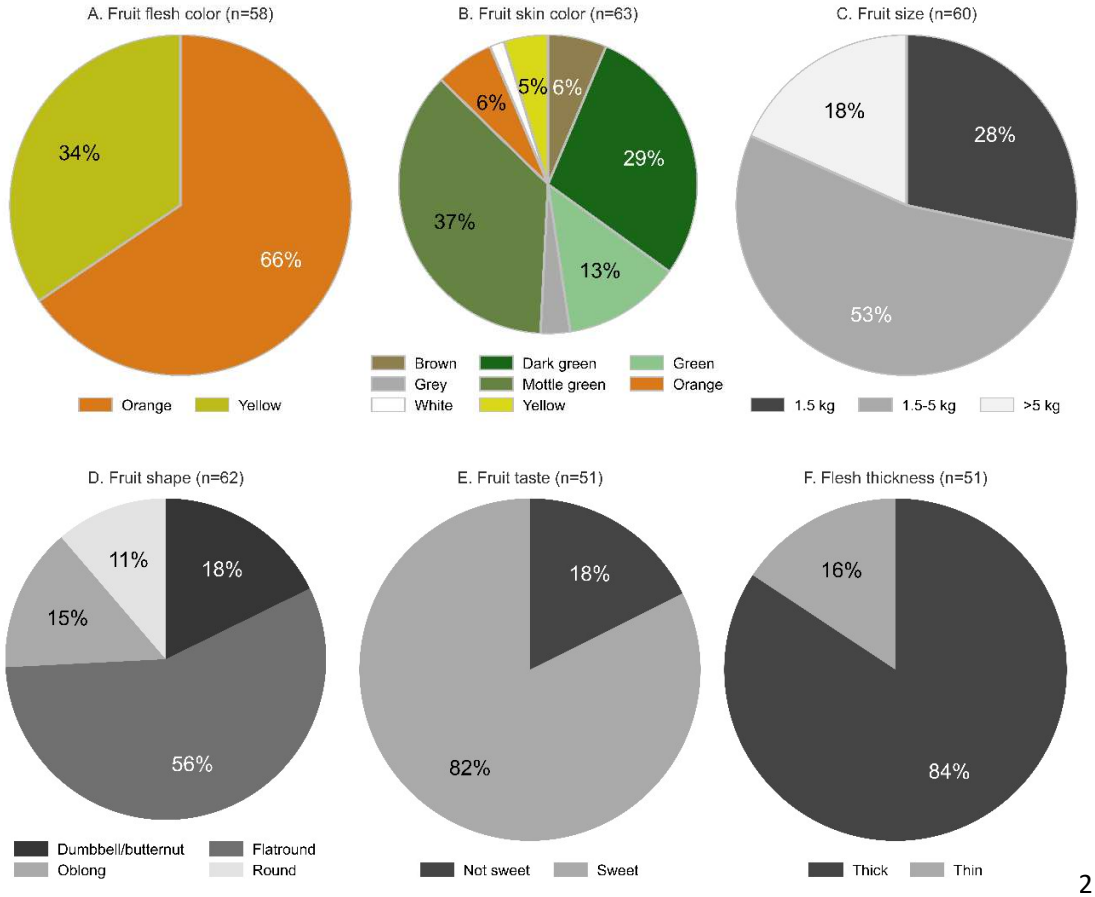

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Figure 16. Pumpkin market types, 2025

Loofah

For loofah, WorldVeg focuses on ridge and sponge gourd. Unfortunately, we did not clearly record this difference in the survey. However, the data for nearly 50 market types shows that most seed companies have market segments with dark green (45% of market types) and green (37%) fruit color and cylindrical fruit shape (52%).

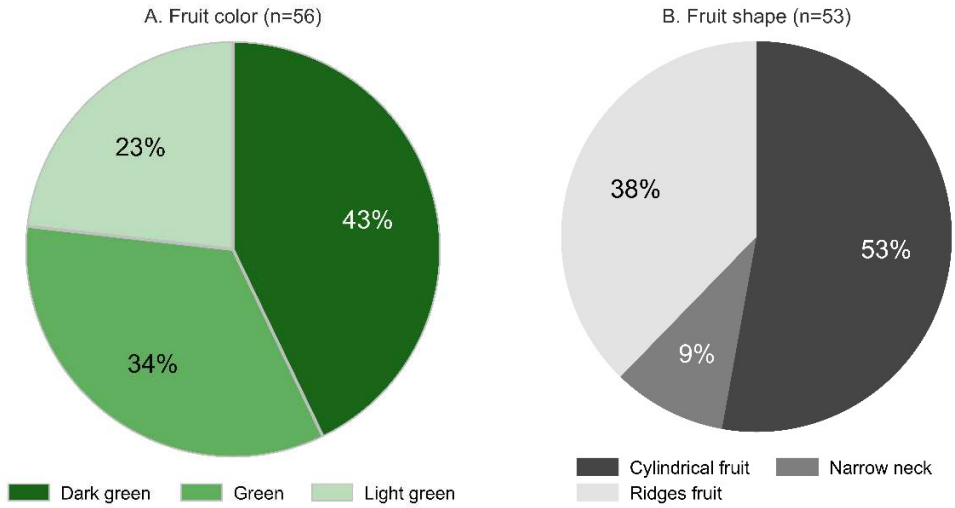

Figure 17. Loofah market types, 2025

Tomato

For tomatoes, we asked companies to rank the importance of three market segments: fresh market, processing, and cherry tomatoes. The question was asked for the current market and the expected market situation 10 years from now. The results show that fresh market tomatoes are clearly the most important segment for most companies, as 24 out of 25 companies ranked it as number one. The second most important segment is processing tomatoes, with cherry tomatoes ranked third. The expected market situation in ten years' time closely resembles the current market situation.

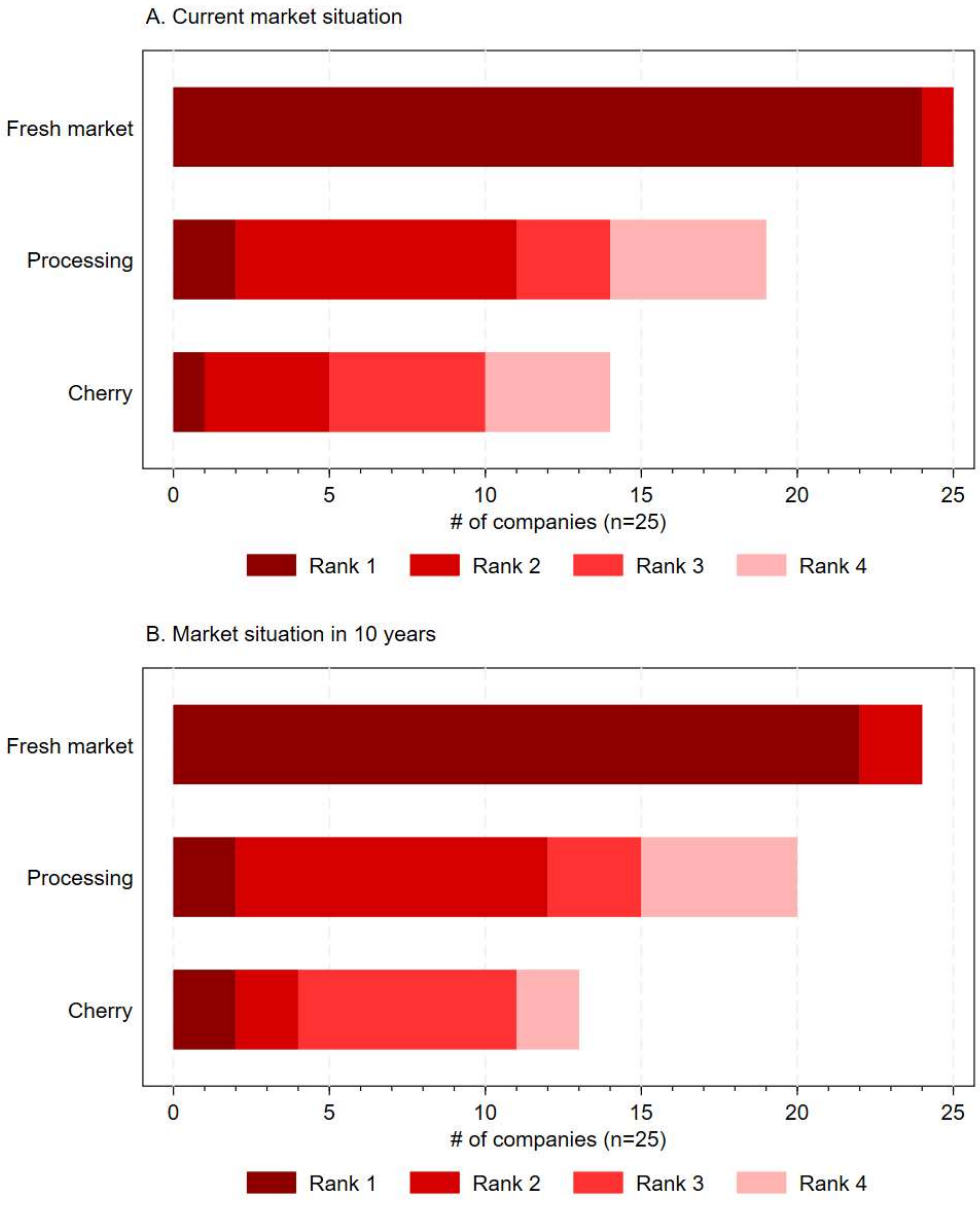

Figure 18 Tomato main market types currently (A) and in 10 years from now (B)

7 Role of WorldVeg germplasm in varieties

Seed companies were asked to provide the names of varieties containing WorldVeg-developed germplasm and to indicate how WorldVeg germplasm was used using standard options listed in Figure 19.

For tomato, seed companies have mostly used WorldVeg-developed traits such as bacterial wilt resistance, late blight resistance, and heat stress tolerance – and 27% of tomato and 40% of pepper varieties are derived from a particular WorldVeg breeding line as a parent for a hybrid.

Regarding bitter gourd, of the 47 commercial varieties we have data for, 70% are hybrids with one parent supplied by WorldVeg, and 15% are full WorldVeg hybrids. Four of the seven commercial pumpkin varieties reported in 2024 are a WorldVeg line, cross, or hybrid.

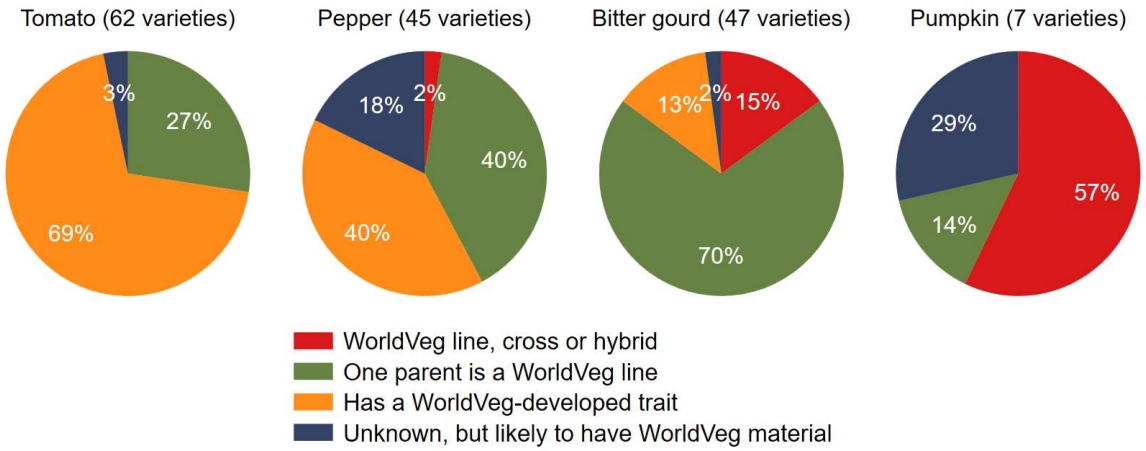

Figure 19. Method of use of WorldVeg germplasm in commercial varieties, 2024

8 Prioritized traits for breeding

Tomato

The questionnaire listed 28 possible traits for tomato breeding. Respondents had to indicate how much they wanted WorldVeg to prioritize each trait, with answers ranging from low/very low, medium, high, and very high. For tomato breeding (Figure 20), the top five traits identified by respondents representing 31 companies are begomovirus resistance, bacterial wilt resistance, heat tolerance, yield, and Tomato brown rugose fruit virus (ToBRFV) resistance, followed by keeping quality (shelf-life) and tospovirus resistance. These top-7 traits are the same as last year, although the order differs.

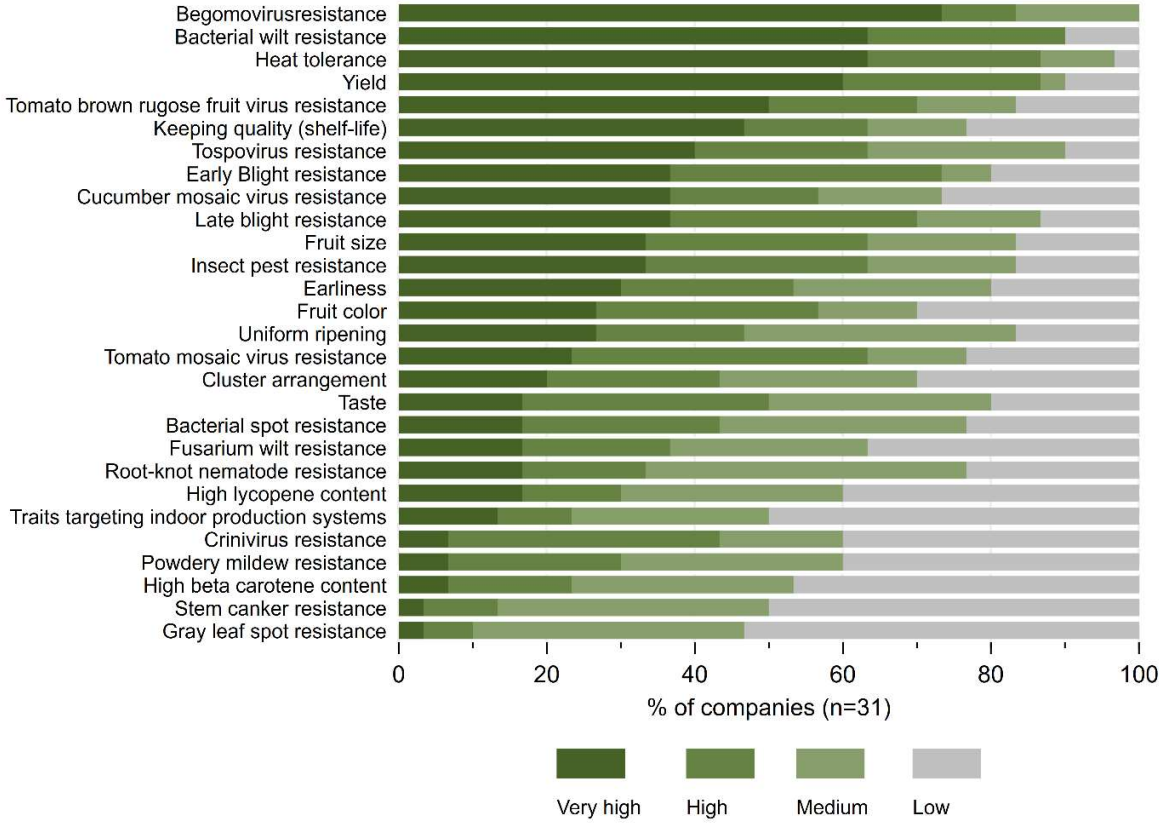

Figure 20 Priority traits for tomato

Note: A few companies mentioned these additional priorities for breeding:
(a) *Fusarium solani* resistance;
(b) High fruit load with earliness, rejuvenation and having determinant plant habit;
(c) No fruit cracking;
(d) Small blossom end-point; and
(e) stem scar.
Notes on scientific names of plant diseases: Bacterial wilt (*Ralstonia spp.*); Phytophthora blight (*Phytophthora capsici*); Late blight (*Phytophthora infestans*); Anthracnose (*Colletotrichum* spp.); Early blight (*Alternaria solani*); Stem Canker (*Alternaria alternata*); Gray leaf spot (*Stemphylium solani*); Bacterial spot (*Xanthomonas*); Fusarium wilt (*Fusarium oxysporum* f. sp. *lycopersici*)

Pepper

For pepper, the questionnaire listed 27 traits (Figure 21). The top five traits that companies would like WorldVeg to prioritize are begomovirus (leaf curl virus) resistance, anthracnose resistance, high yield, heat tolerance, and thrips resistance, which are exactly the same traits as last year and the year before.

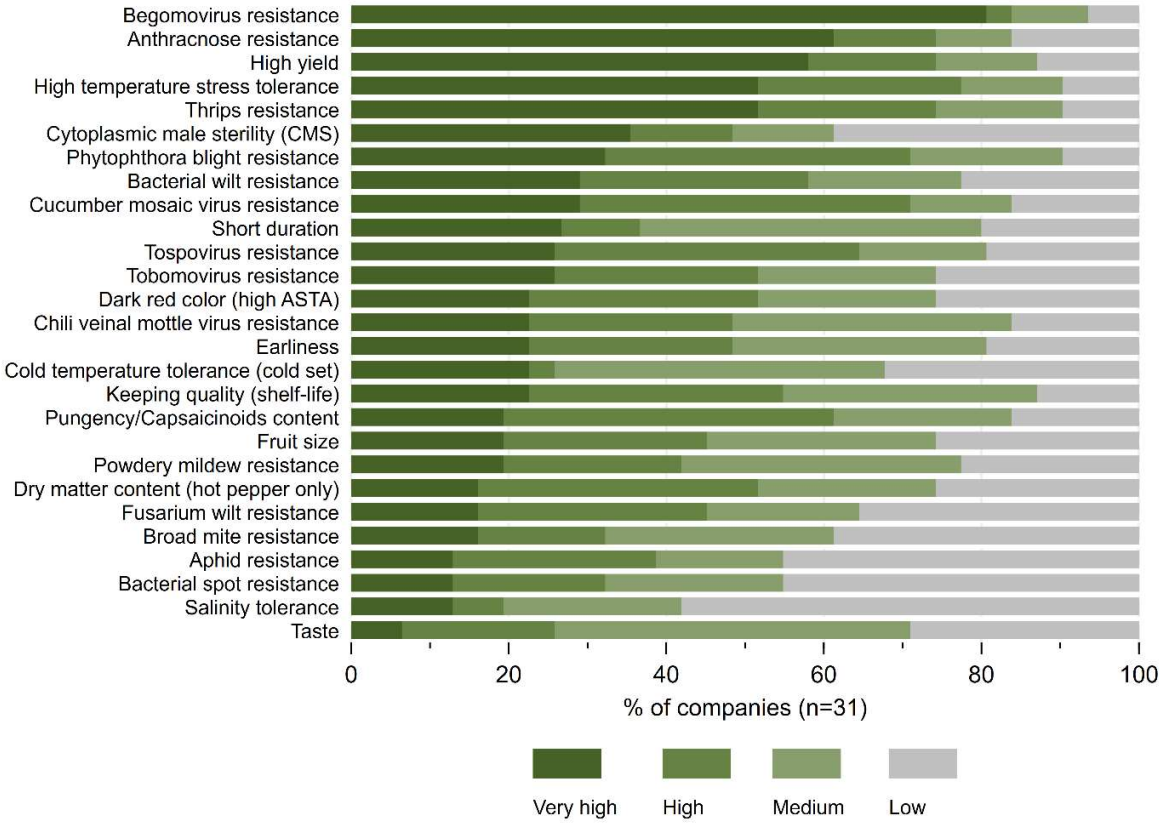

Figure 21. Priority traits for pepper

Bitter gourd

The questionnaire listed 19 traits of bitter gourd (Figure 22). The top five traits that companies would like WorldVeg to prioritize are begomovirus resistance, powdery mildew resistance, high yield, gynoecious line development, and high female/male flower ratio—exactly the same as last year and the year before, but in a slightly different order. Downy mildew resistance was added as a trait to the list based on the request of companies last year, and was given the sixth highest priority.

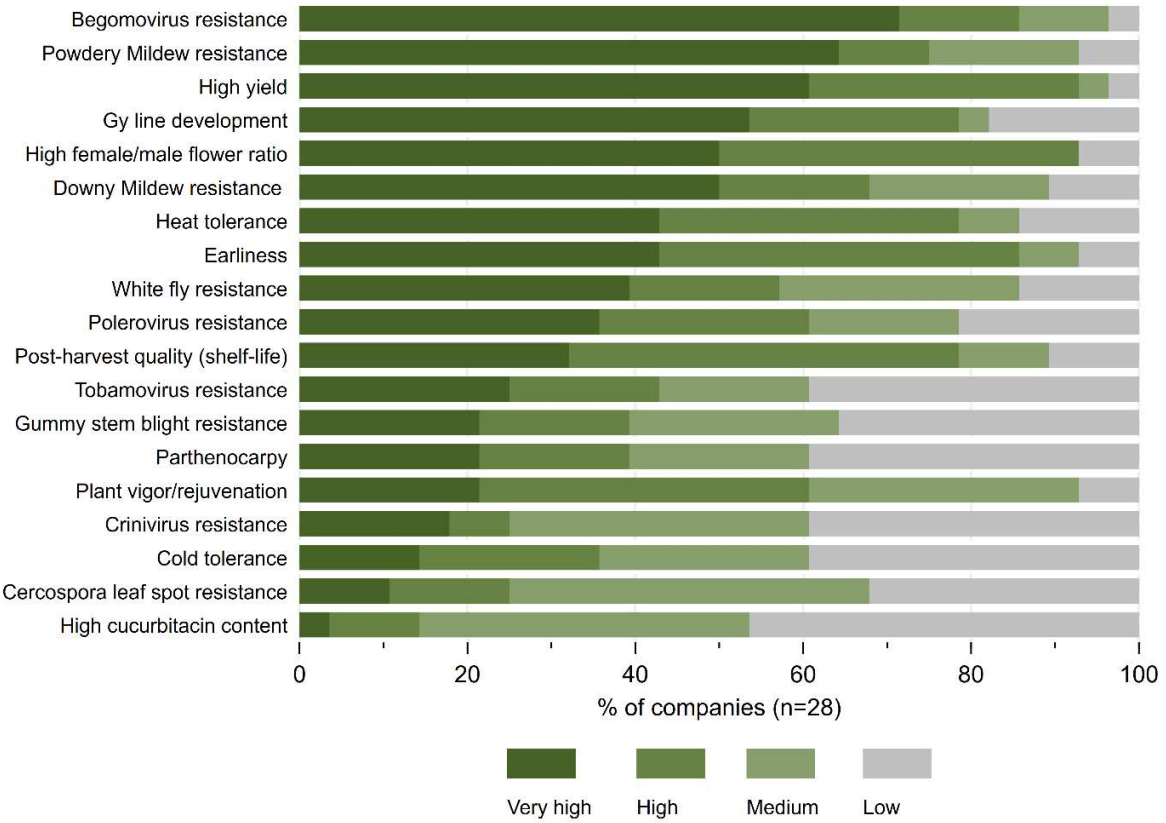

Figure 22. Priority traits for bitter gourd

Pumpkin

The questionnaire listed 17 different traits of pumpkins (Figure 23). The top six traits listed by respondents of 20 companies are begomovirus resistance, high yield, powdery mildew resistance, small seed cavity, and gummy stem blight resistance. Only the first two are the same as last year, although powdery mildew resistance also ranked high in the survey two years ago.

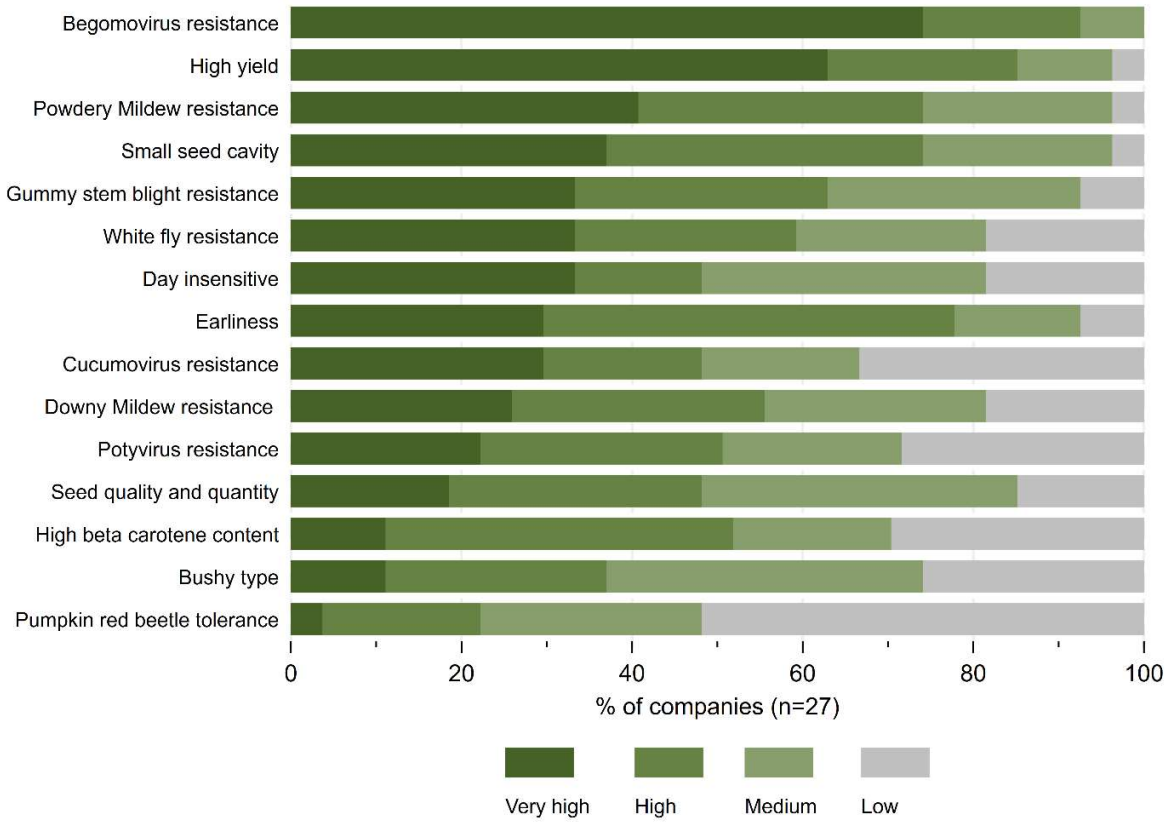

Figure 23 Priority traits for pumpkin

Loofah

The questionnaire listed 18 possible traits of loofah (Figure 24). The top five traits listed by respondents of 24 companies are begomovirus resistance, high yield, high female/male flower ratio, downy mildew resistance, and powdery mildew resistance.

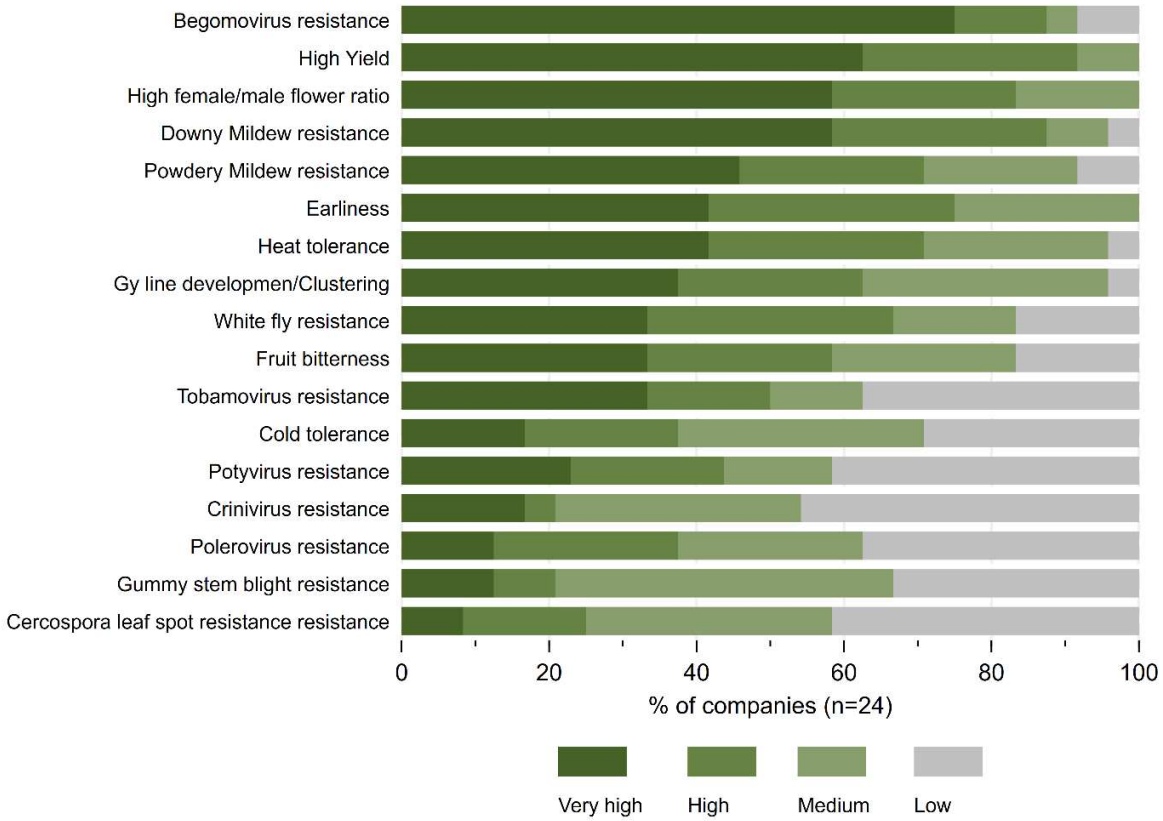

Figure 24 Priority traits for loofah

9 Desired markers

As a new feature in the 2025 survey, we asked respondents which traits they would like WorldVeg to prioritize for developing molecular markers. The results show that begomovirus resistance is the most important trait for marker development for all crops (Figure 25). The number of other highly desired markers is high for tomatoes, including bacterial wilt resistance, early blight resistance, Tomato brown rugose fruit virus resistance, and heat tolerance. For pepper, the most desired markers are for anthracnose and thrips resistance, besides begomovirus resistance. Markers for powdery mildew and downy mildew rank high for cucurbits.

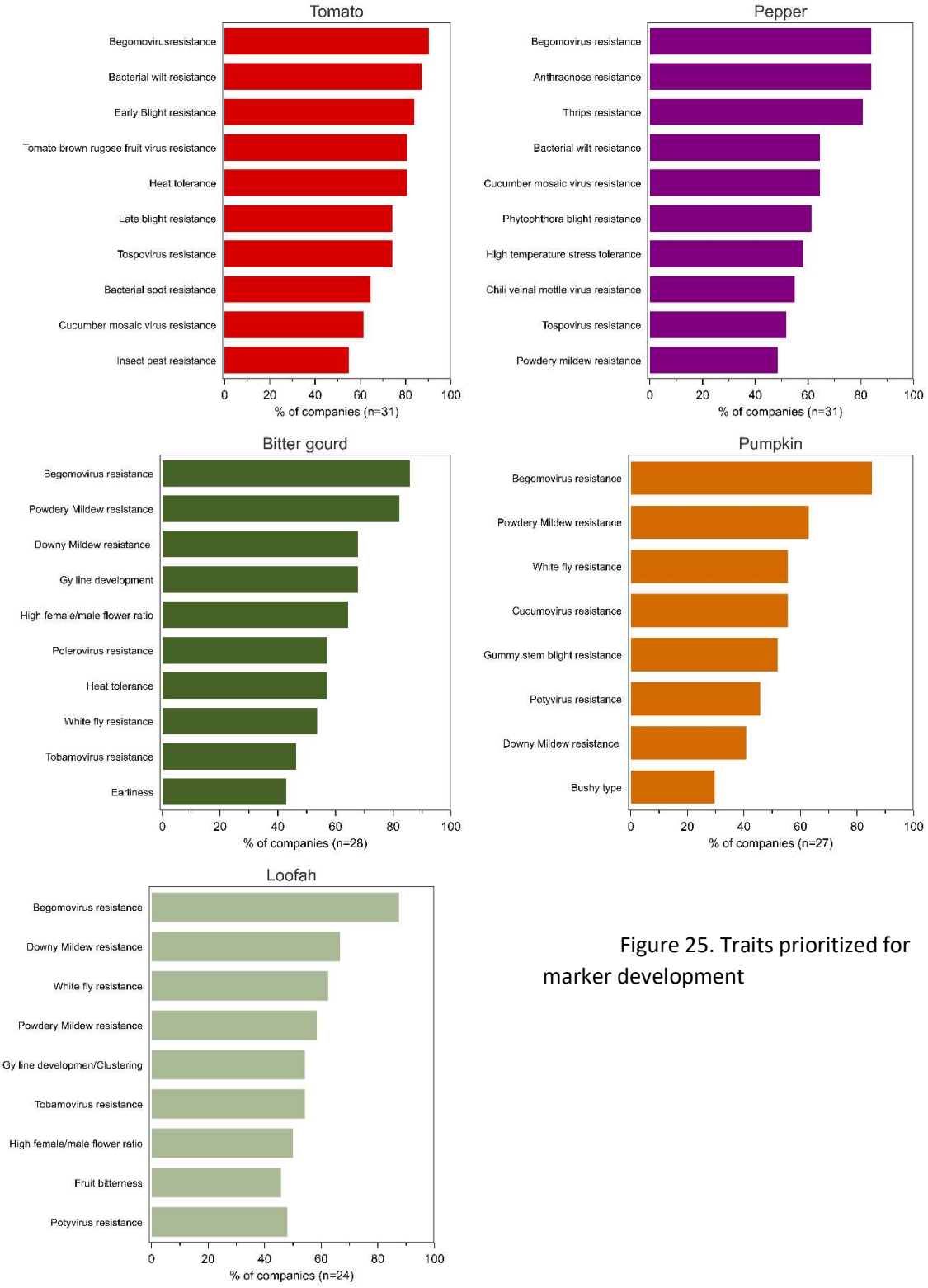

Figure 25. Traits prioritized for marker development

Annex 1: Seed companies that joined or left the Consortium in 2024

Table A1. Seed companies that joined or left the Consortium in 2024

Seed company name	Country	Previous membership
Companies that joined in 2024:		
1. Agroisia Seeds Pvt. Ltd.	India	New member
2. Bucolic Seeds Co., Ltd.	Taiwan	New member
3. Corntech Seeds Pvt. Ltd.	India	New member
4. Eldorado Agritech Pvt. Ltd.	India	New member
5. Farmer Seed and Agricultural Co., Ltd.	Taiwan	New member
6. Global Seeds India Private Limited	India	New member
7. Moti Seeds Pvt. Ltd.	India	New member
8. Oriama Seeds	Pakistan	New member
9. Pan Seeds Pvt. Ltd.	India	New member
10. Ramgo International Corporation	Philippines	New member
11. Suntech Seed Co., Ltd.	Taiwan	New member
12. Tropica Seeds Pvt. Ltd.	India	New member
13. Akshay Seeds Private Limited	India	New member
14. Evergrowseed Co., Ltd.	Taiwan	New member
15. KWS Vegetables B.V.	Netherlands	New member
16. Ramiro Arnedo S.A.	Spain	New member
17. Sanatech Seed Co., Ltd.	Japan	New member
18. Yuksel Tohum A.S.	Turkey	New member
Companies that left in 2024:		
19. Certus Seeds	Pakistan	2020-2023
20. Chakra Seeds, Bharat Nursery Pvt. Ltd.	India	2020-2023
21. Landmark Agro Seeds (Private) Limited	Sri Lanka	2020, 2021, 2023
22. Nath Bio Genes (India) Ltd.	India	2019-2023
23. Nongwoo Seed India Pvt Ltd	India	2019-2023
24. Nunhems Bv (BASF/Monsanto)	Netherlands/India	2019-2023
25. Rallis India Limited (Metahelix Life Sciences Pvt. Ltd.)	India	2018-2023
26. Shriram Bioseed Genetics (A Division of DSCL)	India	2017, 2019-2023
27. Noble Seeds	India	2017, 2018, 2022, 2023
28. United Genetics India Pvt. Ltd.	India	2018, 2019, 2023
29. Nova Genetic/Technisem	France	2021-2023
30. Excel Genetics Ltd.	India	2023
31. R K Seed Farms (R)	India	2023
32. Siam Best Seeds India Pvt. Ltd.	Thailand	2023
33. Sohni Dharti International	Pakistan	2023
34. Vairom Crop Science Pvt. Ltd.	Saudi Arabia	2023

Annex 2: Membership data

Table A2. Past and present members of the APSA-WorldVeg Consortium, 2017-2024

Company	Country	2017	2018	2019	2020	2021	2022	2023	2024
Acsen HyVeg Pvt. Ltd.	India	0	0	1	1	0	0	1	1
Advanta Enterprises Ltd.	India	0	1	1	1	0	0	1	1
Agroisia Seeds Pvt. Ltd.	India	0	0	0	0	0	0	0	1
Ajeet Seeds Pvt. Ltd.	India	0	0	0	0	0	0	1	1
Akshay Seeds Pvt. Ltd.	India	0	0	0	0	0	0	0	1
Ankur seeds Pvt. Ltd.	India	0	1	0	0	0	0	1	1
BHN Seed	USA	0	0	0	1	0	0	0	1
Beijing Bannerseeds Oriental Agriculture Development Co. Ltd.	China	0	0	1	0	0	0	0	0
Bucolic Seeds Co., Ltd.	Taiwan	0	0	0	0	0	0	0	1
Certus Seeds	Pakistan	0	0	0	1	1	1	1	0
Ch. Khair Din & Sons (CKD Seeds & Fertilizer)	Pakistan	0	0	1	1	0	1	1	1
Chakra Seeds, Bharat Nursery Pvt. Ltd.	India	0	0	0	1	1	1	1	0
Chia Tai Co.	Thailand	0	0	1	1	1	1	1	1
Chung Kuan Seed Co., Ltd.	Thailand	0	0	0	1	0	1	1	1
Clover Seed Co., Ltd.	Hong Kong, China	1	1	1	1	1	1	1	1
Comienzo Agri Science Limited (previously Sattva Seeds Pvt. Ltd.)	India	0	1	1	1	1	0	1	1
Corntech Seeds Pvt. Ltd.	India	0	0	0	0	0	0	0	1
Degao Vegetable Seed and Seedling Research Institute	China	0	0	1	0	0	0	0	0
East-West Seed International Limited	Thailand	1	1	1	1	1	1	1	1
Eldorado Agritech Pvt. Ltd.	India	0	0	0	0	0	0	0	1
Enza Zaden Asia Sdn Bhd	India	1	1	1	0	1	0	1	1
Evergrowseed Co., Ltd.	Taiwan	0	0	0	0	0	0	0	1
Excel Genetics Ltd.	India	0	0	0	0	0	0	1	0
Farmer Seed and Agricultural Co., Ltd.	Taiwan	0	0	0	0	0	0	0	1
Feltrin Sementes Ltda	Brazil	0	0	1	0	1	1	1	1
Flotech Seeds Co., Ltd.	Thailand	0	0	0	1	0	0	0	0
Gemini Seeds Pvt. Ltd.	India	0	0	0	0	1	0	0	0
Genting Green Sdn Bhd	Malaysia	0	0	0	0	1	1	1	1
Global Seeds India Pvt. Ltd.	India	0	0	0	0	0	0	0	1
HM. Clause India Pvt. Ltd.	India	1	1	1	1	1	1	1	1
I & B Seeds Pvt. Ltd.	India	1	1	1	1	1	1	1	1
Indo-American Hybrid Seeds (India) Pvt. Ltd.	India	0	0	1	1	0	0	0	1
JK Agri Genetics Ltd.	India	1	1	1	0	0	0	0	0
KWS Vegetables B.V.	Netherlands	0	0	0	0	0	0	0	1
Kagome Co., Ltd.	Japan	0	1	1	0	0	0	0	0

Company	Country	2017	2018	2019	2020	2021	2022	2023	2024
Kalash Seeds Pvt. Ltd.	India	0	1	0	1	1	0	1	1
Kaneko Seeds Co., Ltd.	Japan	0	0	0	1	0	0	0	0
Kaveri Seed Co., Ltd.	India	0	1	0	1	1	1	1	1
Known-You Seed Co., Ltd.	Taiwan	0	0	1	1	0	0	1	1
Kumar Bioseeds and Agro Products Pvt. Ltd. (KF Bioplant Pvt. Ltd.)	India	1	1	0	0	0	0	0	0
Landmark Agro Seeds (Private) Limited	Sri Lanka	0	0	0	1	1	0	1	0
Laxmi Inputs	India	0	0	0	1	0	0	0	0
Loc Troi Joint Stock Company	Viet Nam	0	0	0	1	0	0	0	0
Mahindra Agri Solutions Ltd.	India	1	1	1	0	1	1	0	0
Mahyco Pvt. Ltd. (previously Sungro Seeds Pvt. Ltd.)	India	0	1	1	1	1	1	1	1
Mehr Muhammad Din and Sons	Pakistan	0	0	1	0	0	0	0	0
Monsanto Holdings Pvt. Ltd.	India	0	0	1	1	1	1	1	1
Monsoon Foods	India	0	0	0	0	1	1	0	0
Moti Seeds Pvt. Ltd.	India	0	0	0	0	0	0	0	1
Musashino Seed Co., Ltd.	Japan	0	1	0	0	0	0	0	0
Namdhari Seeds Pvt. Ltd.	India	0	1	1	1	1	1	1	1
Nath Bio Genes (India) Ltd.	India	0	0	1	1	1	1	1	0
Nethra Enterprises Pvt. Ltd.	India	0	1	0	0	0	0	0	0
Noble Seeds	India	1	1	0	0	0	1	1	0
Nong Woo Bio	South Korea	0	0	0	0	1	1	0	0
Nongwoo Seed India Pvt. Ltd.	India	1	1	1	1	1	1	1	0
Nova Genetic/Technisem	France	0	0	0	0	1	1	1	0
Nu Genes Pvt. Ltd.	India	0	0	0	1	0	0	0	0
Nunhems BV (BASF)	Netherlands/India	1	1	1	1	1	1	1	0
Nuziveedu Seeds Ltd.	India	0	0	0	1	1	1	1	1
Onesh Agri Pvt. Ltd.	Sri Lanka	0	0	1	1	1	0	0	1
Oriama Seeds	Pakistan	0	0	0	0	0	0	0	1
PT. BISI International Tbk	Indonesia	1	1	1	0	1	1	1	1
PT. East West Seed Indonesia (EWINDO)	Indonesia	1	1	1	1	1	1	1	1
PT. Tani Murni Indonesia	Indonesia	0	0	0	0	0	1	0	0
Pahuja Seeds Pvt. Ltd.	India	0	0	0	0	0	0	1	1
Pan Seeds Pvt. Ltd.	India	0	0	0	0	0	0	0	1
R K Seed Farms (R)	India	0	0	0	0	0	0	1	0
Rallis India Limited (previously Metahelix Life Sciences Pvt. Ltd.)	India	0	1	1	1	1	1	1	0
Ramgo International Corporation	Philippines	0	0	0	0	0	0	0	1
Ramiro Arnedo S.A.	Spain	0	0	0	0	0	0	0	1
Rijk Zwaan	India	1	1	1	1	1	1	1	1
Ruchi Hi-rich Seeds Pvt. Ltd.	India	0	0	1	0	0	0	1	1
Saitama Genshu Ikuseikai Co., Ltd.	Japan	0	0	0	0	0	1	0	0
Sakata Seed Corporation	Japan	0	1	1	1	0	1	1	1

Company	Country	2017	2018	2019	2020	2021	2022	2023	2024
Sanatech Seed Co., Ltd.	Japan	0	0	0	0	0	0	0	1
Seedworks International Pvt. Ltd.	India	1	1	1	1	1	1	1	1
Semillas Fito India Pvt. Ltd.	India	0	0	0	1	0	0	0	1
Shouguang Yinong Horticulture Co., Ltd.	China	0	0	1	0	0	0	0	0
Shriram Bioseed Genetics (A Division of DSCL)	India	1	0	1	1	1	1	1	0
Siam Best Seeds India Pvt. Ltd.	Thailand	0	0	0	0	0	0	1	0
Sing-Flow Seed Co., Ltd.	Taiwan	0	1	1	1	1	1	1	1
Sohni Dharti International	Pakistan	0	0	0	0	0	0	1	0
Starke Ayres (Pty) Ltd.	South Africa	0	0	0	0	0	1	0	1
Suntech Seed Co., Ltd.	Taiwan	0	0	0	0	0	0	0	1
Syngenta India Limited	India	1	1	1	1	1	1	1	1
Takii & Company, Ltd.	Japan	1	1	1	1	1	1	1	1
Tierra Seed Science Pvt. Ltd.	India	0	0	1	0	0	0	0	0
Tokita Seed India Pvt. Ltd.	India	0	1	1	1	1	1	1	1
Tropica Seeds Pvt. Ltd.	India	0	0	0	0	0	0	0	1
United Genetics India Pvt. Ltd.	India	0	1	1	0	0	0	1	0
VNR Seeds Pvt. Ltd.	India	0	1	0	0	0	0	1	1
Vairom Crop Science Pvt. Ltd.	Saudi Arabia	0	0	0	0	0	0	1	0
Welcome Crop Science Pvt. Ltd.	India	1	0	1	1	0	0	0	0
Your Chain Seed Co., Ltd.	Taiwan	0	0	1	1	1	1	1	1
Yuksel Tohum A.S.	Turkey	0	0	0	0	0	0	0	1
Zenith Hybrid Seeds Pvt. Ltd.	India	0	0	0	0	0	1	0	0

The World Vegetable Center is an international nonprofit institute for vegetable research and development. It mobilizes resources from the public and private sectors to realize the potential of vegetables for healthier lives and more resilient livelihoods.

WorldVeg's globally important genebanks, improved varieties, production and postharvest methods help farmers to increase their vegetable harvest, raise incomes in poor rural and urban households, create jobs, and provide healthier, more nutritious diets for families and communities. With headquarters in Taiwan, field operations are led from regional centers in Benin, India, Mali, Tanzania and Thailand, and through offices in other countries.

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