Supplementary Table 1. Search scopes of patents of New Breeding Technology.

Patents	Patent Offices	DB	Dates	Search Fields
Publicated[z]	KIPO[y] JPO[x] USPTO[w] CNIPA[v] EPO[u] WIPO[t]	KIPRIS, WIPSON	1998.01.01. ~ 2020.07.10	Bibliography +Abstract +Claims

[z]'Publicated' patents are patents that are 'open to public' after 18 months since its application filing, including granted, rejected, abandoned, as well as pending legal status, [y]KIPO (Korean Intellectual Property Office), [x]JPO (Japan Patent Office), [w]USPTO (The United States Patent and Trademark Office), [v]CNIPA (China National Intellectual Property Administration), [u]EPO (European Patent Office), [t]WIPO (World Intellectual Property Organization)

Supplementary Table 2. Search terms for patents of New Breeding Technology.

Technology Fields	Search Terms
New Breeding Technology for crop improvements using gene editing technology	((zfn (zinc adj finger) 징크핑거 진크핀가 talen ((transcription adj activator) and nuclease) 탈렌 fokI "전사 활성화 인자형 이펙터 뉴클레아제" (tal adj 뉴클레아제) crispr crispr/cas crispr-cas 크리스퍼 tracrRNA crRNA sgRNA cpf1* c2c2* c2c1* cas9* dcas9* RGEN RNP PAM "protospacer adjacent motif" 신육종기술 "new breeding technology" (유전자 adj 가위) (gene adj scissor) ((유전체 유전자 게놈 gene genome 염기 핵산 base) adj (교정 편집 수정 edit*)) ((유도 안내 가이드) adj (RNA 알엔에이)) (guide adj RNA) gRNA (site and directed and nuclease) "SDM" "ODM" (oligonucleotide adj directed adj mutagenesis) ((target* adj gene) and knockout) (off adj target) (표적 adj (게놈 절단)) (표적화 adj 핵산) (target* adj genome) 비표적 "아데닌 염기 교정" "adenine base editor" "시토신 염기 교정" "cytosine base editor" meganuclease endonuclease nuclease 엔도뉴클레아제 엔도뉴크레아제 엔도뉴클레이즈 엔도뉴크레이즈 엔도누클레아제 뉴클레이즈 뉴클레아제 뉴클라제 누클레아제)) AND (((C12N-015*).ipc.) (질산염 nitrate 터페노이드 terpenoid 카로티노이드 카로테노이드 carotenoid carotinoid 녹말 starch ((고온 저온 가뭄 염 병 해충 바이러스 heat cold drought salt disease pest insect virus) adj (내성 tolerance)) ((비생물적 환경적 abiotic) adj (스트레스 stress)) (fruit adj color) 과색 소포자(microspore adj isolat*) 활성산소종(reactive and oxygen and species) "ROS" 수발아(viviparous adj germination) (유용 adj 유전자) (enhanced adj production) (생산* adj 증대) (RNA adj (메틸화 methylat*)) 알러지 알레르기 allerg* (개화 adj 시기) (flowering adj time) 추대 bolting 플라보노이드 후라보노이드 flavonoid 프라보노이드 기공 stomata 글루코시놀레이트 glucosinolate) (작물 식물 농작물 원예 채소 과수 과채 화훼 벼 콩 토마토 유채 버섯 사과 상추 면화 감자 밀 옥수수 알팔파 애기장대 고추 배추 가지 파프리카 순무 오이 브로콜리 양배추 당근 페튜니아 crop plant horticultural vegetable fruit flower rice (oryza adj sativa) bean (glycine adj max) tomato (lycopersicon adj esculentum) rapeseed (brassica adj napus) mushroom apple (malus adj pumila) lettuce (lactuca adj sativa) cotton (gossypium adj indicum) potato (solanum adj tuberosum) wheat (triticum adj aesivum) corn maize (zea adj mays) alfalfa (medicago adj sativa) arabidopsis (mouseear adj cress) (arabidopsis adj thaliana) pepper (capsicum adj annuum) cabbage (brassica adj campestris) 가지(solanum adj melongena) paprika turnip (brassica adj rapa) cucumber (cucumis adj sativus) broccoli (brassica adj oleracea) carrot (daucus adj carota) petunia (petunia adj hybrida)))

Supplementary Table 3. Search results of patents of New Breeding Technology in each Patent Office.

Technology Fields	Search Results						
	KIPO[z]	JPO[y]	USPTO[x]	CNIPA[w]	EPO[v]	WIPO[u]	Total
New Breeding Technology for crop improvements using gene editing technology	842	1,714	3,996	5,718	1,944	2,544	16,758

[z]KIPO (Korean Intellectual Property Office), [y]JPO (Japan Patent Office), [x]USPTO (The United States Patent and trademark Office), [w]CNIPA (China National Intellectual Property Administration), [v]EPO (European Patent Office), [u]WIPO (World Intellectual Property Organization)

Supplementary Table 4. Criteria for selection of valid patents of New Breeding Technology.

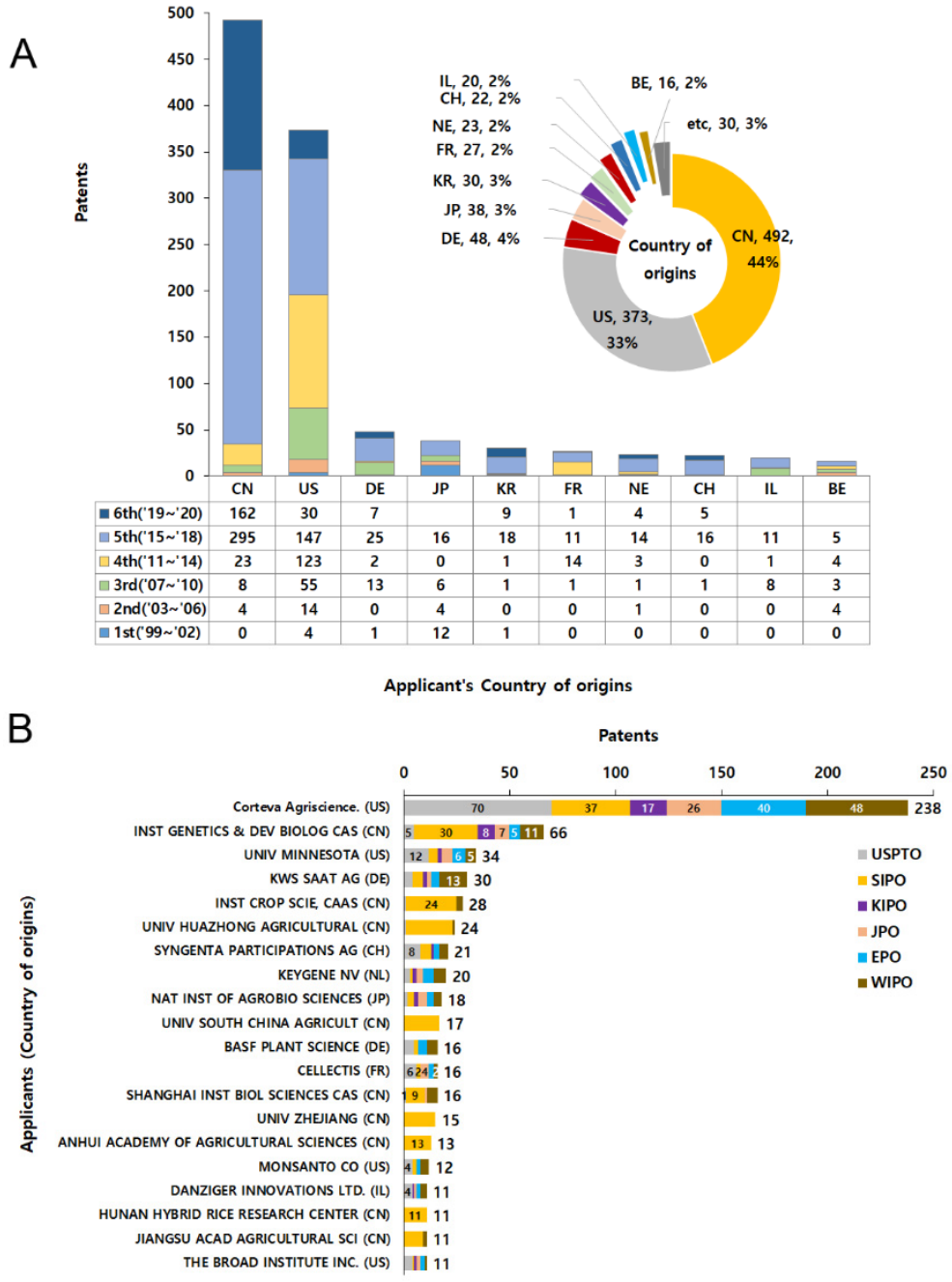
Technology Fields	Group	Criteria for valid patents
New Breeding Technology for crop improvements using gene editing technology	ZFN	Patents claiming ZFN[z] based gene editing technology which is applied to plants/crops including rice, corn, soybean, wheat, canola, tomato, cabbage, pepper, mushroom, apple, lettuce, cotton, potato, carrot, petunia, alfalfa.
	TALEN	Patents claiming TALEN[y] based gene editing technology which is applied to plants/crops including rice, corn, soybean, wheat, canola, tomato, cabbage, pepper, mushroom, apple, lettuce, cotton, potato, carrot, petunia, alfalfa.
	CRISPR	Patents claiming CRISPR[x] based gene editing technologies using guide RNAs and site directed nucleases including CRISPR/Cas9[w] or CRISPR/Cpf1[v] system which is applied to plants/crops including rice, corn, soybean, wheat, canola, tomato, cabbage, pepper, mushroom, apple, lettuce, cotton, potato, carrot, petunia, alfalfa.
	Multi-tech[s]	Patents claiming redundant applications of ZFN, TALEN, CRISPR based gene editing technologies and other SDN[u] based (ODM[t] or meganucleases) genome/gene editing technologies to plants/ crops including rice, corn, soybean, wheat, canola, tomato, cabbage, pepper, mushroom, apple, lettuce, cotton, potato, carrot, petunia, alfalfa.

[z]ZFN (Zinc Finger Nuclease), [y]TALEN (Transcription activator-like effector nucleases), [x]CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats), [w]Cas9 (CRISPR-associated protein 9), [v]Cpf1 (CRISPR-associated endonuclease in *Prevotella* and *Francisella 1*), [u]SDN (Site Directed Nuclease), [t]ODM (Oligonucleotide Directed Mutagenesis), [s]Multi-tech (ZFN and/or TALEN and/or CRISPR and/or ODM and/or meganuclease and/or other)

Supplementary Table 5. Selected valid patents by field of technology in each Patent Office.

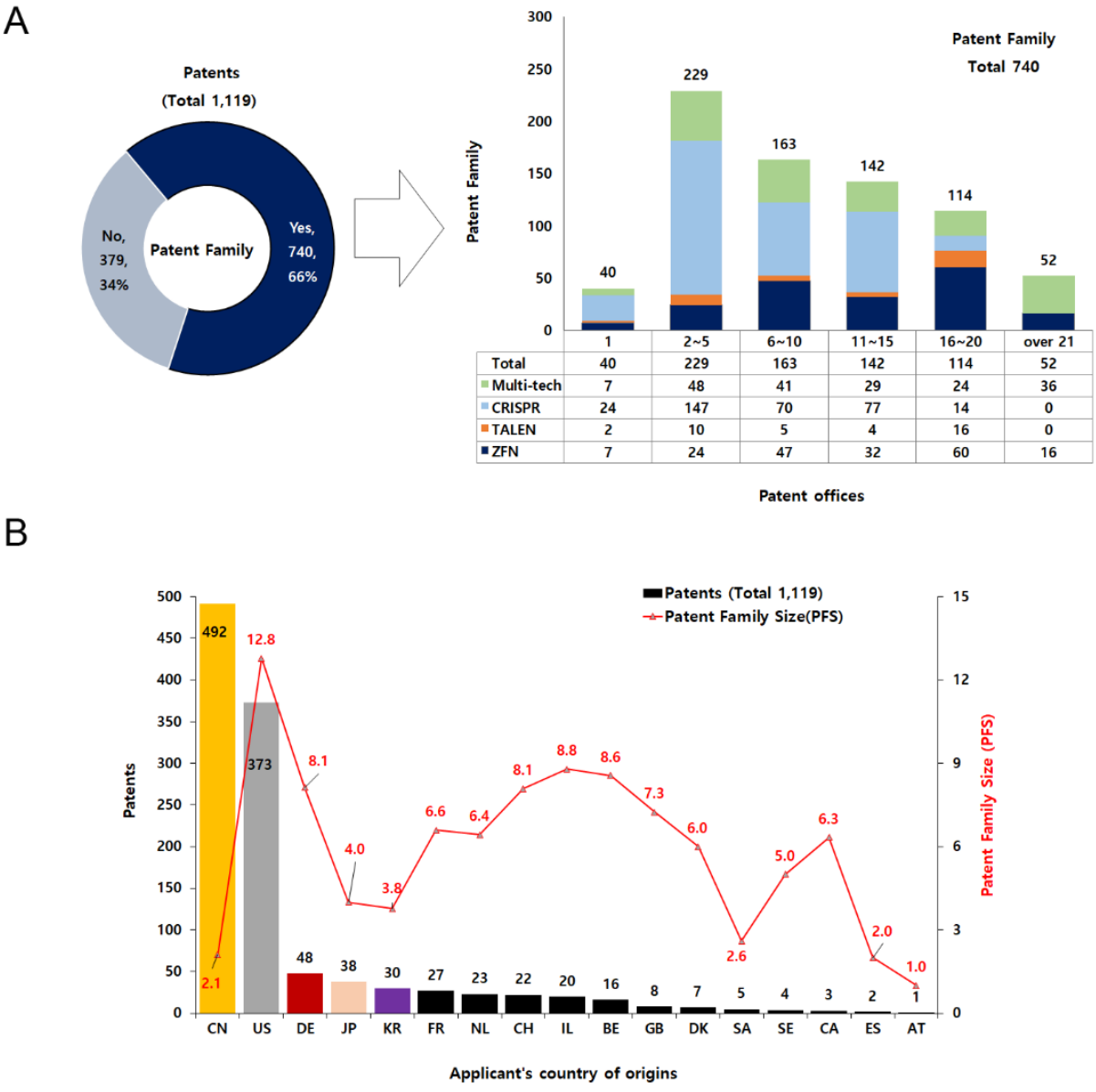
Technology Fields	Group	Valid patents						
		KIPO[z]	JPO[y]	USPTO[x]	CNIPA[w]	EPO[v]	WIPO[u]	Total
New Breeding Technology for crop improvements using gene editing technology	ZFN	12	27	64	37	36	29	205
	TALEN	2	6	12	15	6	6	47
	CRISPR	30	23	71	397	46	102	669
	Multi-tech	16	16	47	47	29	43	198
Total		60	72	194	496	117	180	1,119

[z]KIPO (Korean Intellectual Property Office), [y]JPO (Japan Patent Office), [x]USPTO (The United States Patent and trademark Office), [w]CNIPA (China National Intellectual Property Administration), [v]EPO (European Patent Office), [u]WIPO (World Intellectual Property Organization)



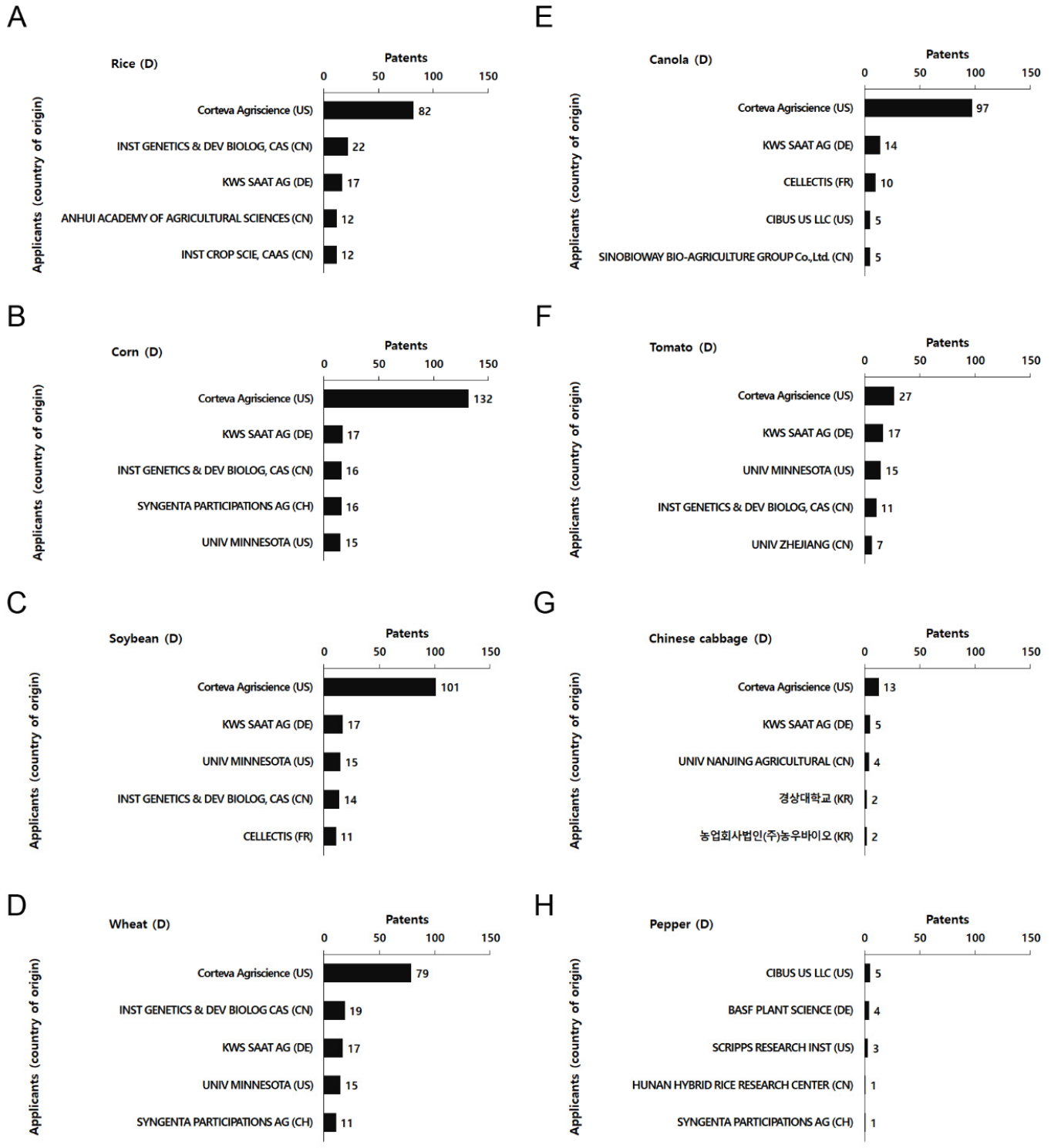
	CN	US	DE	JP	KR	FR	NE	CH	IL	BE
6th('19~'20)	162	30	7		9	1	4	5		
5th('15~'18)	295	147	25	16	18	11	14	16	11	5
4th('11~'14)	23	123	2	0	1	14	3	0	1	4
3rd('07~'10)	8	55	13	6	1	1	1	1	8	3
2nd('03~'06)	4	14	0	4	0	0	1	0	0	4
1st('99~'02)	0	4	1	12	1	0	0	0	0	0

Supplementary Fig. 1. Trends in patent applications of New Breeding Technology by patent applicant's country of origins (Total 1,119). (A) Total of 865 patent applications (77%) out of 1,119 valid patents were filed either by Chinese (492) or US (373) applicants, showing that those two were the leaders of the field of New Breeding Technology. Sharp increases of CRISPR based patent applications in CNIPA by Chinese national has surpassed those in USPTO since 5th period (15'~18'), resulting in the Chinese applicants as the leading group of the New Breeding Technology. (B) Top 20 major patent applicants were ranked by the number of patents in five Patent Offices (KIPO, USPTO, CNIPA, JPO, EPO) and WIPO. Corteva Agriscience with 221 patents, that had inherited global patents of DOW Agriscience LLC, DuPont, Pioneer Hi-Bred Int. by company merges, and became the global number 1 patent applicant in the field of New Breeding Technology.



	1	2~5	6~10	11~15	16~20	over 21
Total	40	229	163	142	114	52
Multi-tech	7	48	41	29	24	36
CRISPR	24	147	70	77	14	0
TALEN	2	10	5	4	16	0
ZFN	7	24	47	32	60	16

Supplementary Fig. 2. Distribution of patent families by each applicant's country of origins and the field of technology. (A) Seven hundred forty patents (66%) out of 1,119 valid patents have filed patent families, indicating the potential market expansion of New Breeding Technology. Distribution of patent families of New Breeding Technology ranged from 1 to over 25 countries. (B) The Patent Family Size (PFS) of each patent applicant's country of origins revealed that US applicants with the highest PFS, 12.8, while Chinese applicants as 2.1.



Supplementary Fig. 3. Top 5 ranked patent applicants of New Breeding Technology by major crop species. (A) Rice. Corteva Agriscience (US) was the major patent applicants with 82 patents. (B) Corn. Corteva Agriscience (US) was the major patent applicants with 132 patents. (C) Soybean. Corteva Agriscience (US) was the major patent applicants with 101 patents. (D) Wheat. Corteva Agriscience (US) was the major patent applicants with 79 patents. (E) Canola. Corteva Agriscience (US) was the major patent applicants with 97 patents. (F) Tomato. Corteva Agriscience (US) was the major patent applicants with 27 patents. (G) Chinese cabbage. Corteva Agriscience (US) was the major patent applicants with 13 patents. (H) Pepper. CIBUS US LLC (US) was the major patent applicants with 82 patents.