FIG. 1

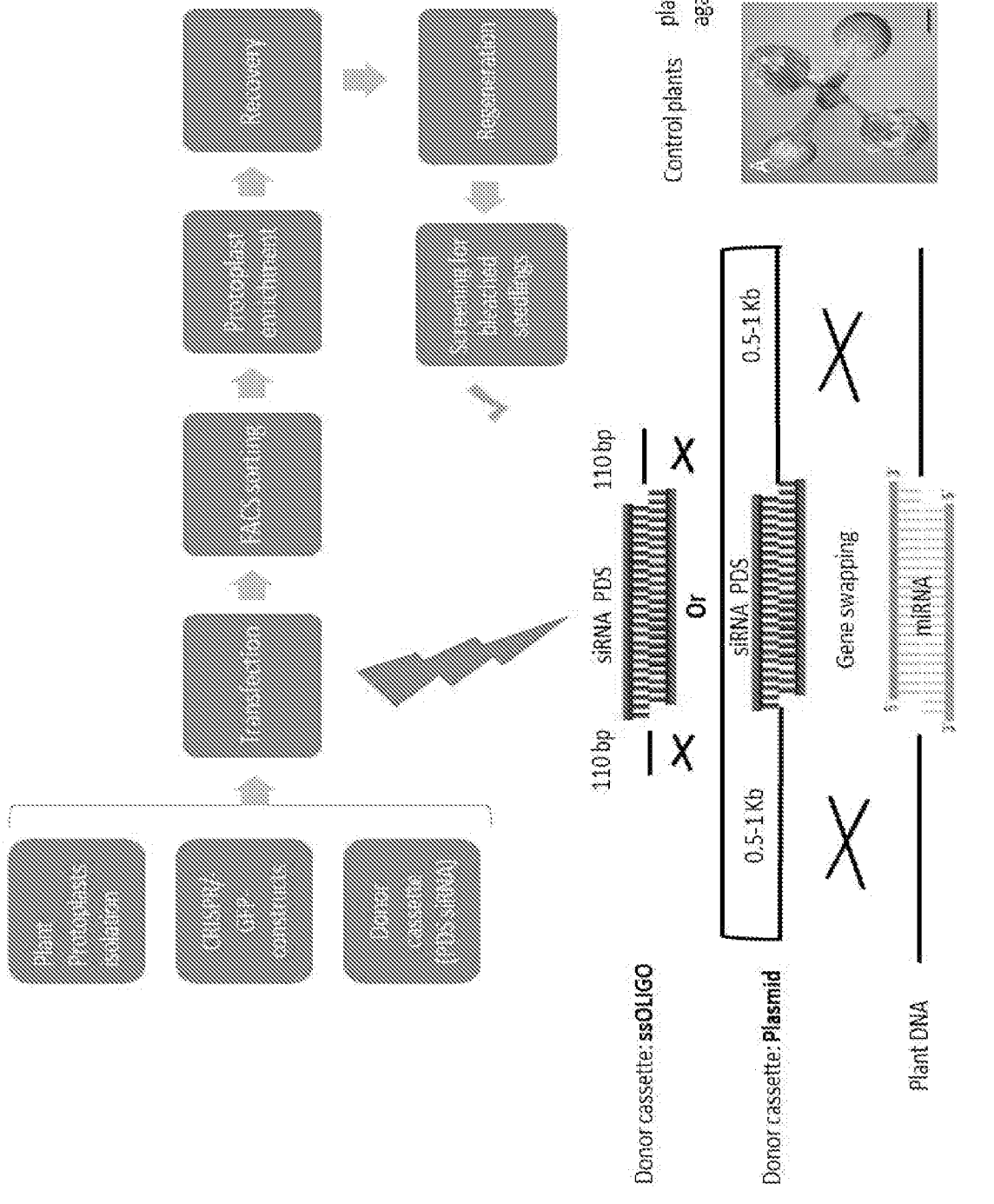

Control plants
plant expressing siRNA against PDS (Bleached plants)
Donor cassette: ssOLIGO
110 bp
siRNA PDS
110 bp
Or
Donor cassette: Plasmid
0.5-1 Kb
siRNA PDS
0.5-1 Kb
Gene swapping
miRNA
Plant DNA



FIG. 2A

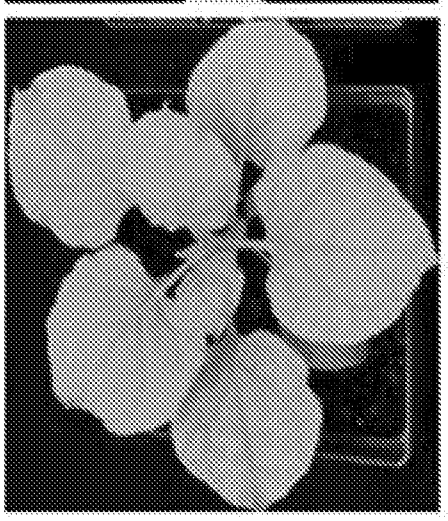


FIG. 2B

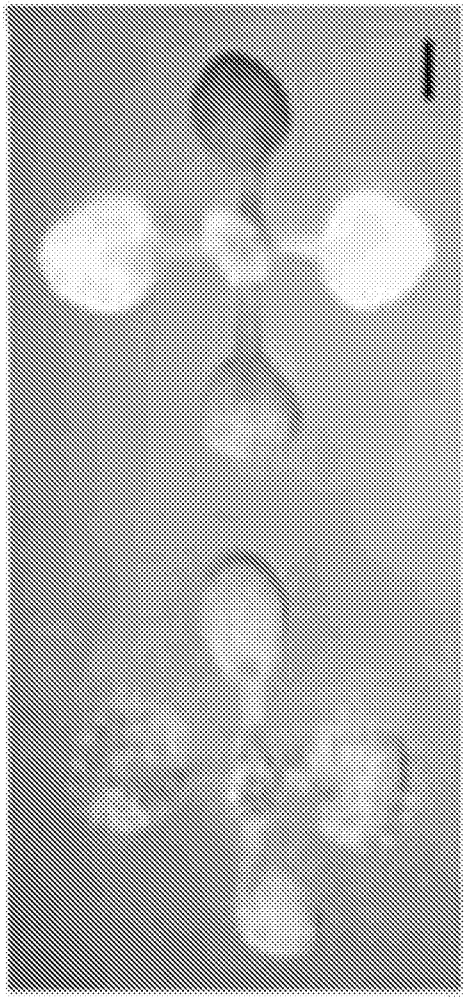


FIG. 2C

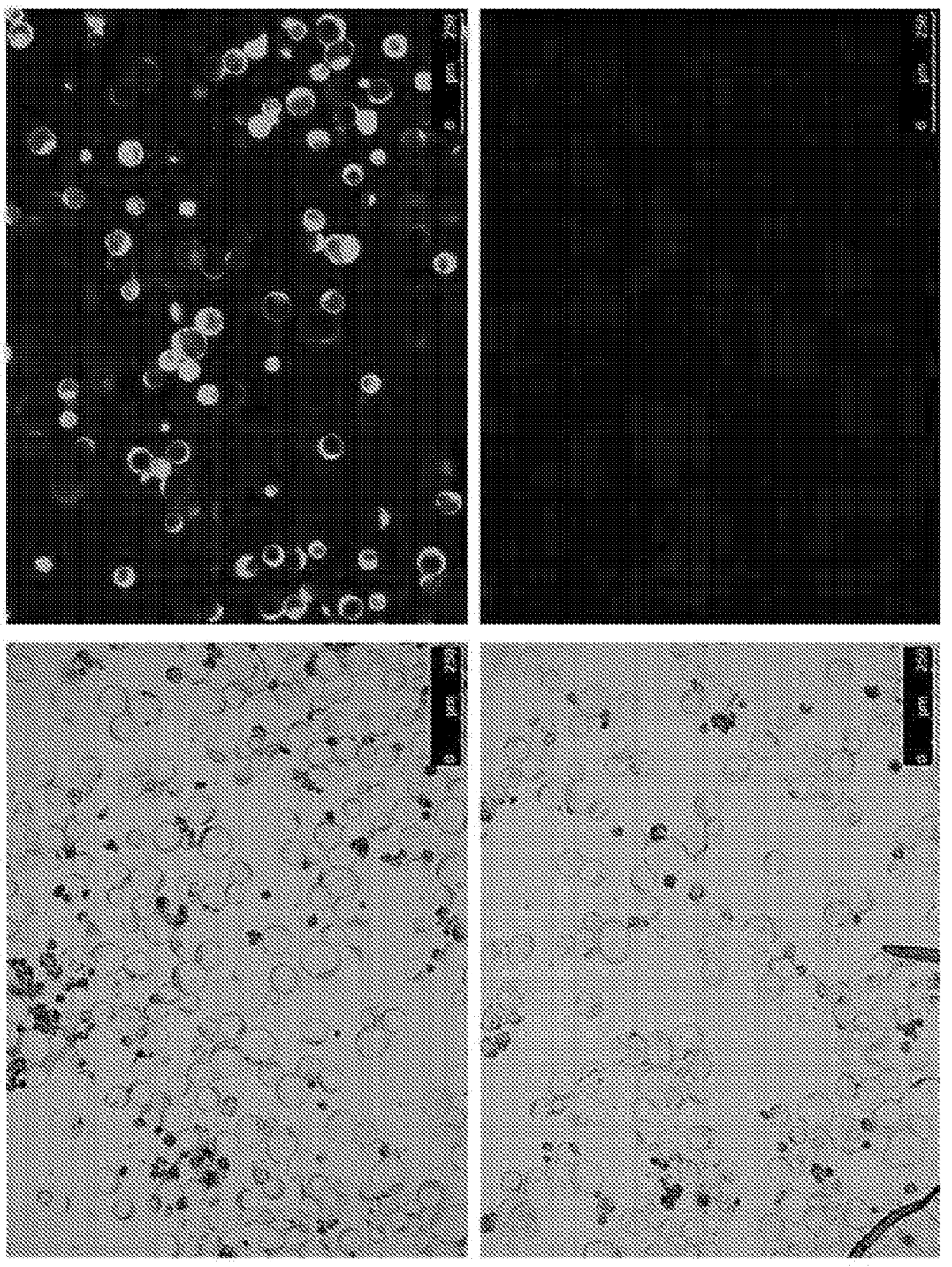


FIG. 3A

FIG. 3B

FIG. 3C

FIG. 3D

FIG. 4

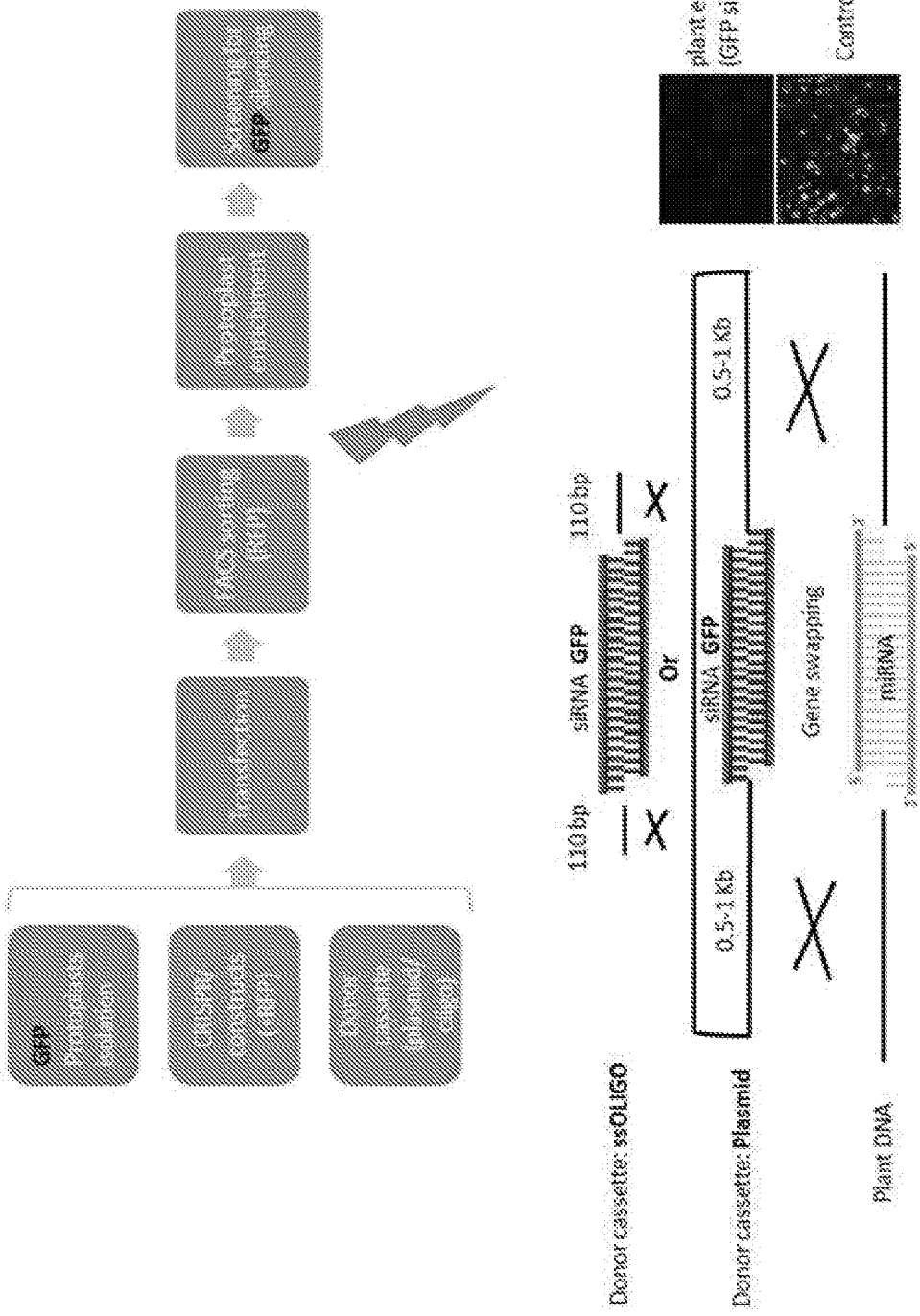

GFP
Donor cassette: ssOLIGO
Donor cassette: Plasmid
Plant DNA
110 bp
siRNA GFP
110 bp
Or
0.5-1 Kb
siRNA GFP
0.5-1 Kb
Gene swapping
miRNA
plant expressing siRNA against GFP
(GFP silencing)
Control plants

FIG. 5

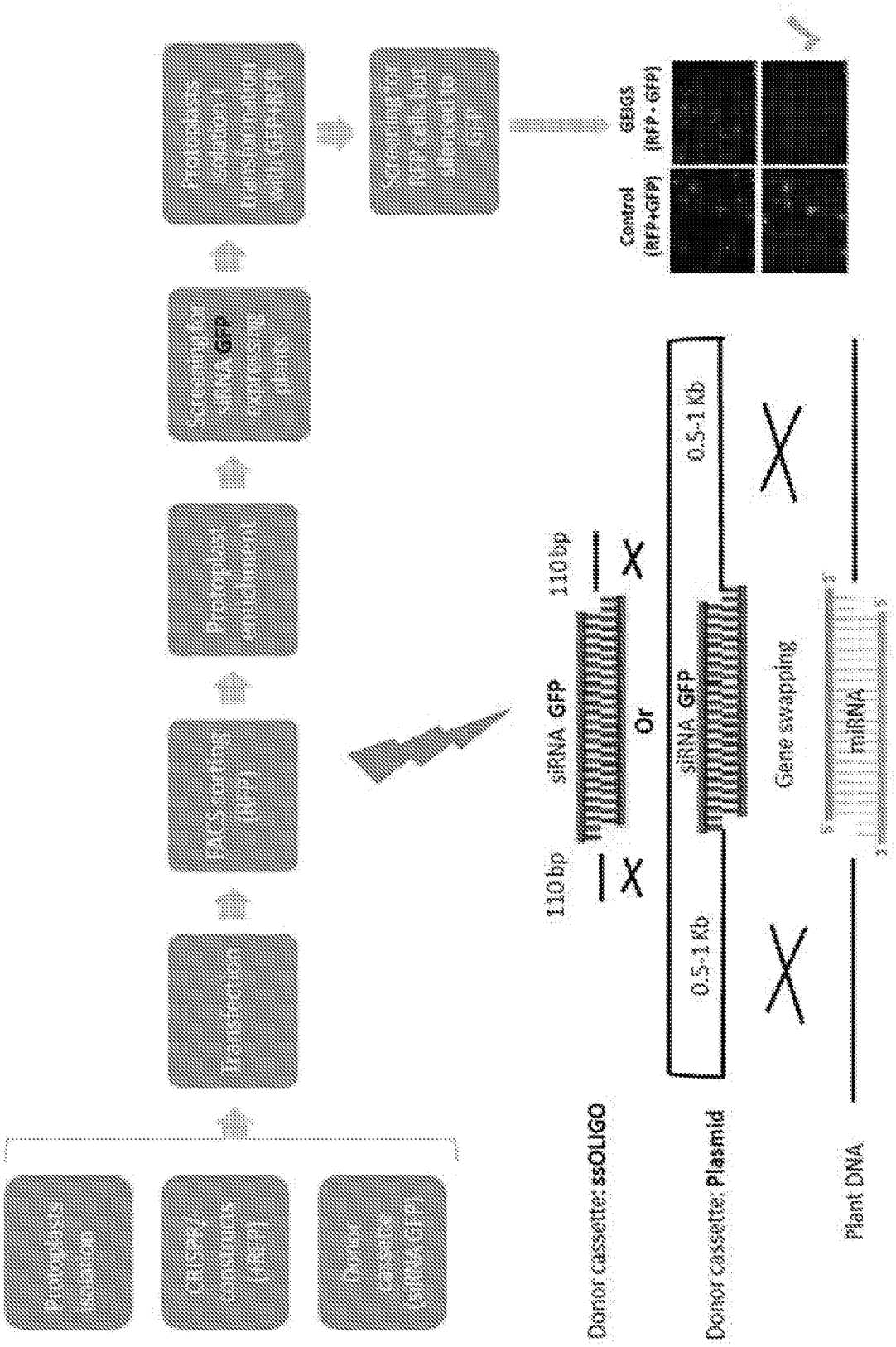

Donor cassette: ssOLIGO
110 bp
siRNA GFP
110 bp
Or
Donor cassette: Plasmid
0.5-1 kb
siRNA GFP
0.5-1 kb
Gene swapping
Plant DNA
miRNA
Control (RFP+GFP)
GEIGS (RFP - GFP)

FIG. 6

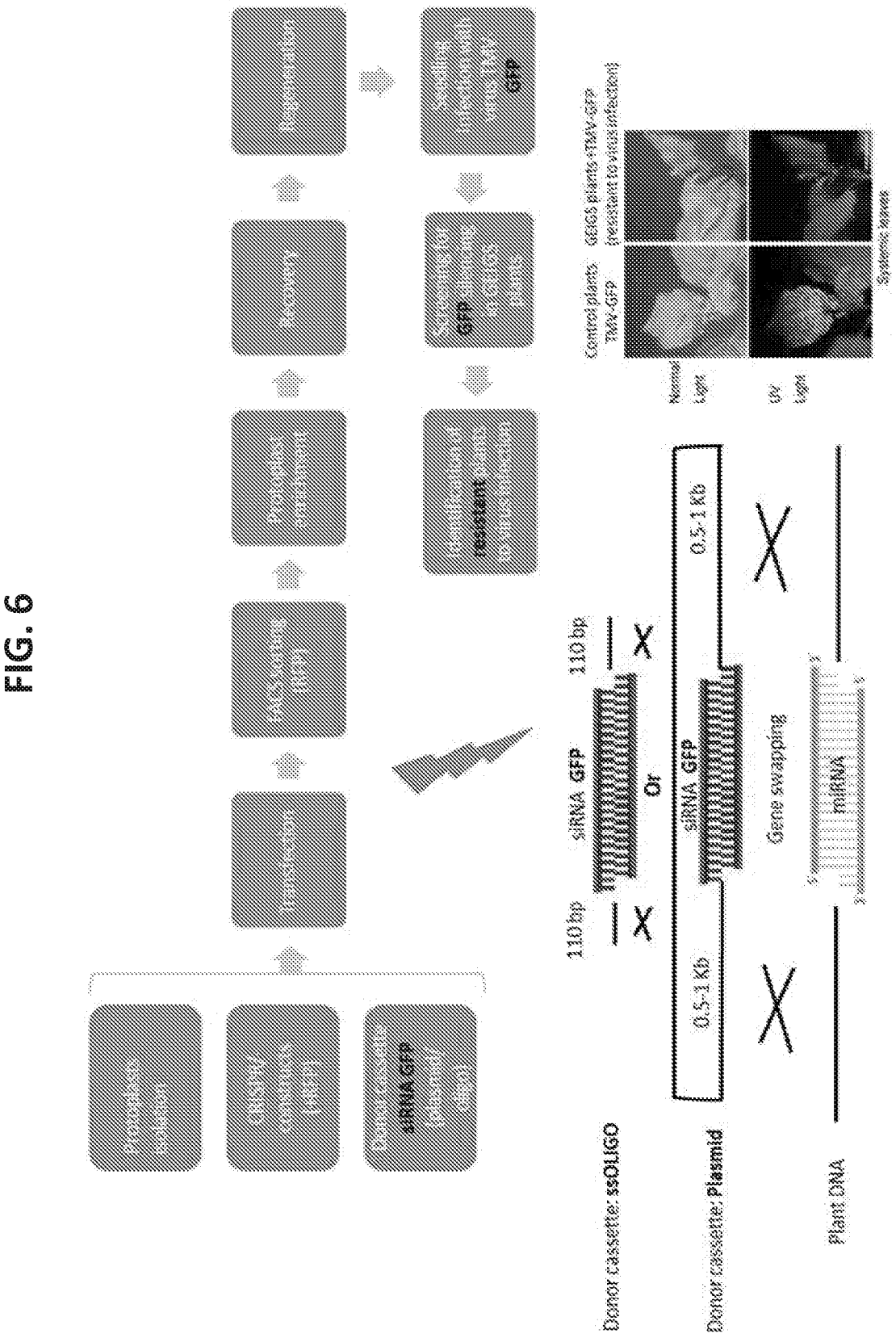

Donor cassette: ssOLIGO
Donor cassette: Plasmid
Plant DNA
110 bp
siRNA GFP
110 bp
Or
0.5-1 Kb
siRNA GFP
0.5-1 Kb
Gene swapping
miRNA
Control plants TMV-GFP
GEGS plants +TMV-GFP (resistant to virus infection)
Normal Light
UV Light
Systemic leaves

FIG. 7



FIG. 8

Crops	Dak Lak		Gia Lai		Kon Tum	
	R. similis	*P. coffeae*	*R. similis*	*P. coffeae*	*R. similis*	*P. coffeae*
Banana	0	+	0	+	0	+
Coffee	+	+	+	+	0	0
Pepper	0	0	0	0	0	0
Durian	0	0	0	0	0	+
Citrus	0	0	0	0	0	+
Pineapple	0	0	0	+	0	0
Ginger	0	0	0	-	0	0
Longan	0	+	0	-	0	0
Mango	0	0	0	0	0	0

+: Nematode was found 0: No nematode was found -: No sample was collected

FIG. 9

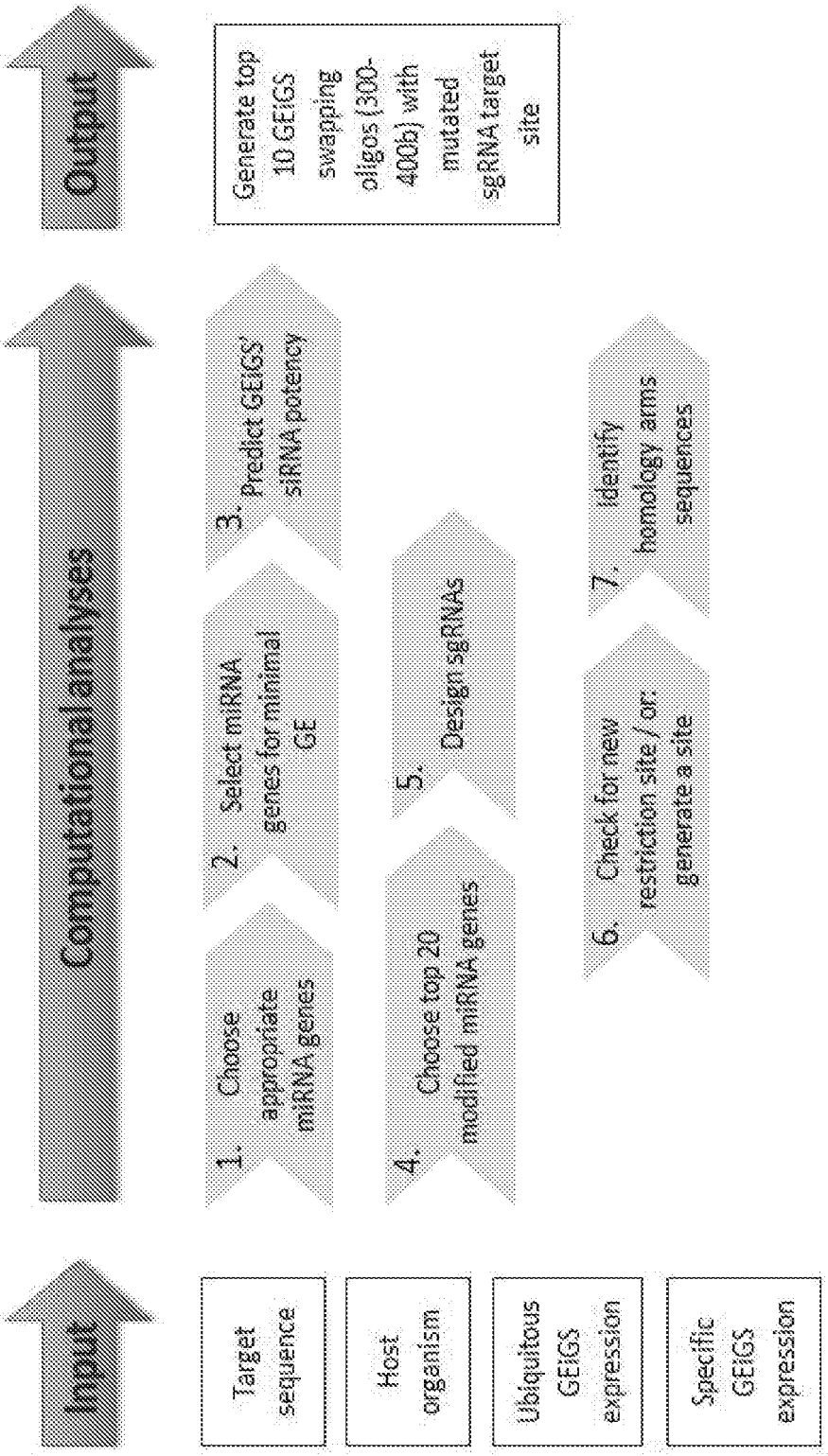

Input
Computational analyses
Output
Target sequence
Host organism
Ubiquitous GEiGS expression
Specific GEiGS expression
1. Choose appropriate miRNA genes
2. Select miRNA genes for minimal GE
3. Predict GEiGS' siRNA potency
4. Choose top 20 modified miRNA genes
5. Design sgRNAs
6. Check for new restriction site / or generate a site
7. Identify homology arms sequences
Generate top 10 GEiGS swapping oligos (300-400b) with mutated sgRNA target site

FIG. 10

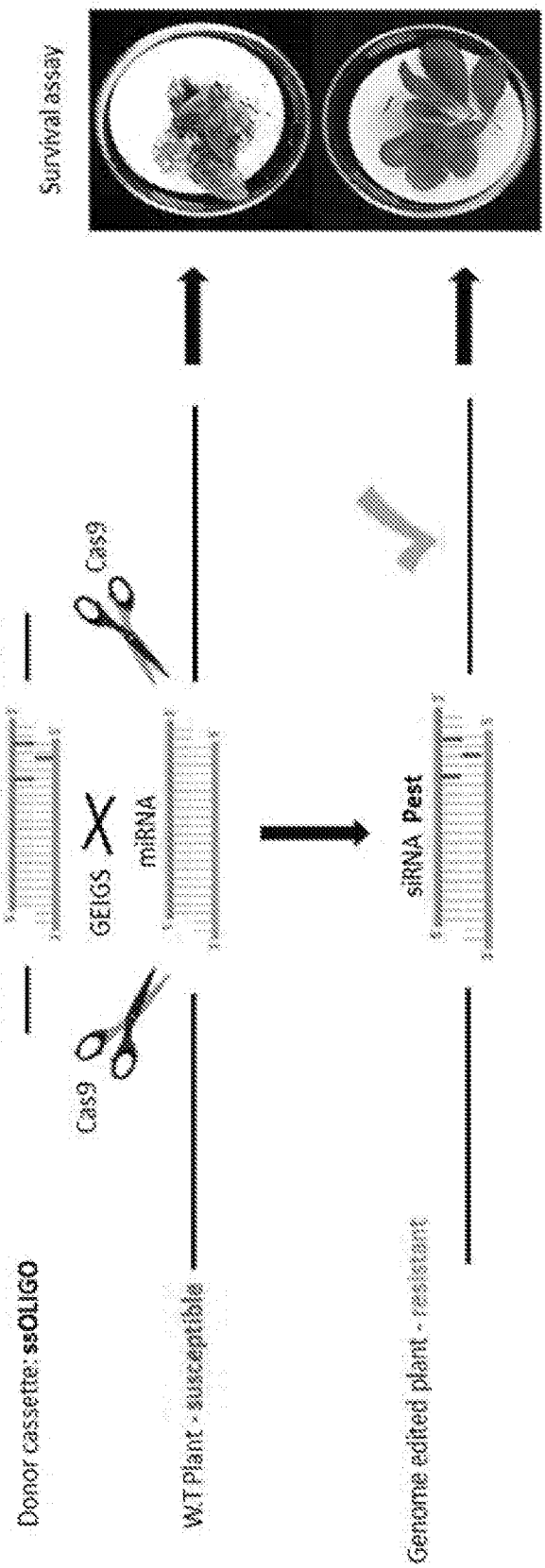
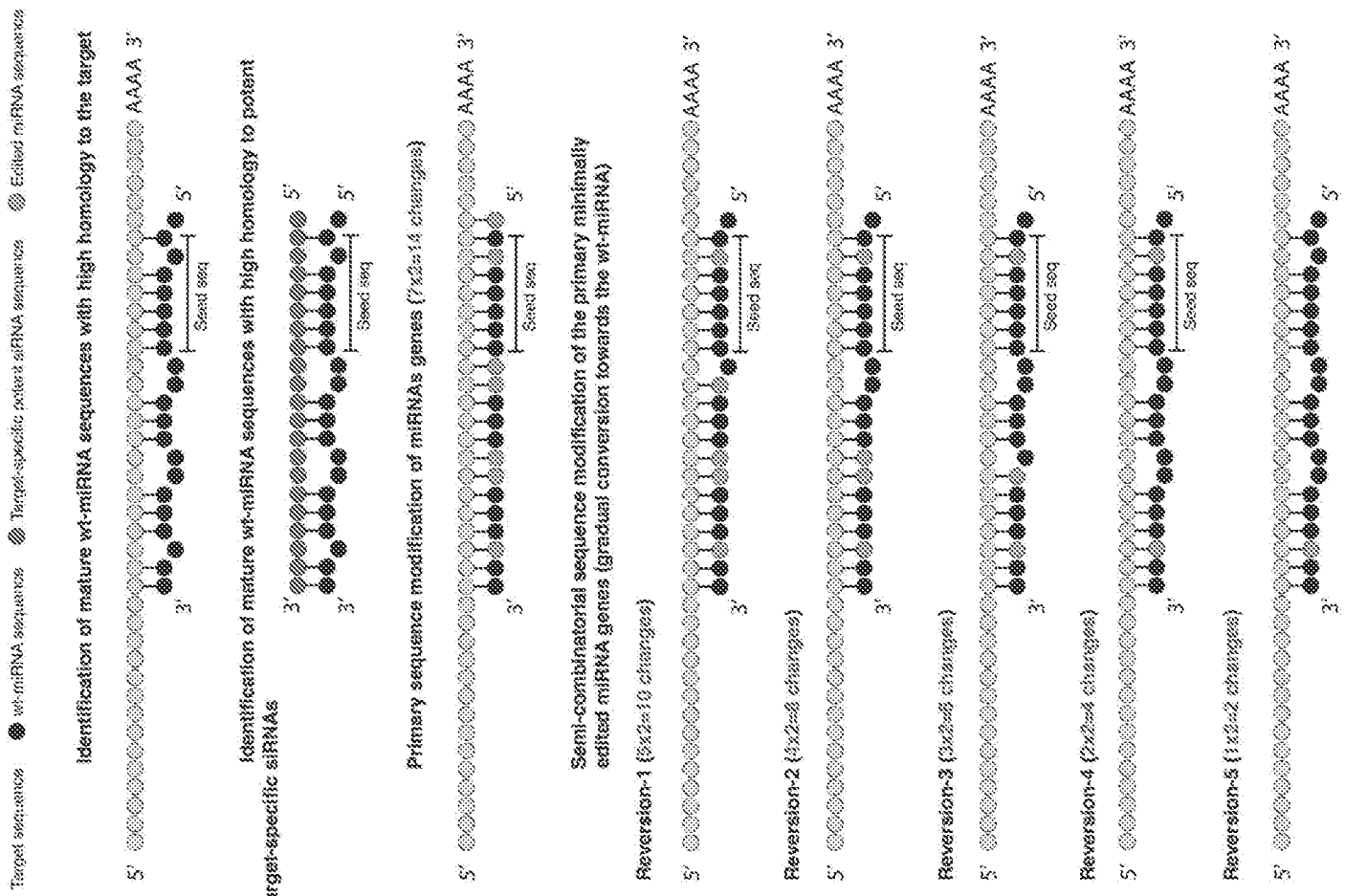

Survival assay
Donor cassette: ssOLIGO
110 bp
siRNA Pest
110 bp
Cas9
GEIGS
miRNA
Cas9
WT Plant - susceptible
siRNA Pest
Genome edited plant - resistant

FIG. 11


Target sequence
wt-miRNA sequence
Target-specific potent siRNA sequence
Edited miRNA sequence
Identification of mature wt-miRNA sequences with high homology to the target
5'
3'
AAAA 3'
5'
Seed seq
Identification of mature wt-miRNA sequences with high homology to potent target-specific siRNAs
3'
5'
3'
5'
Seed seq
Primary sequence modification of miRNAs genes (7x2=14 changes)
5'
3'
AAAA 3'
5'
Seed seq
Semi-combinatorial sequence modification of the primary minimally edited miRNA genes (gradual conversion towards the wt-miRNA)
Reversion-1 (5x2=10 changes)
Reversion-2 (4x2=8 changes)
Reversion-3 (3x2=6 changes)
Reversion-4 (2x2=4 changes)
Reversion-5 (1x2=2 changes)

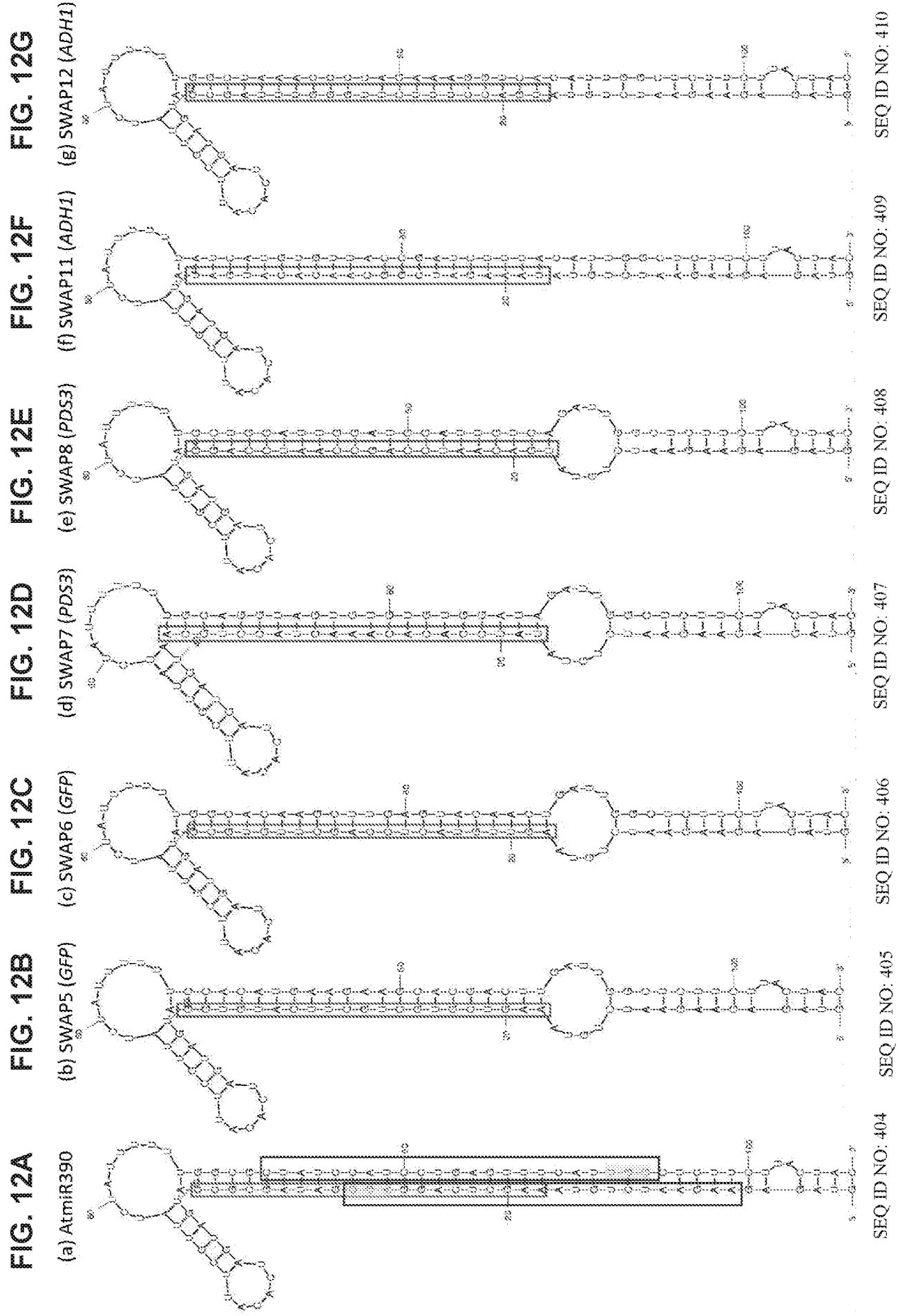
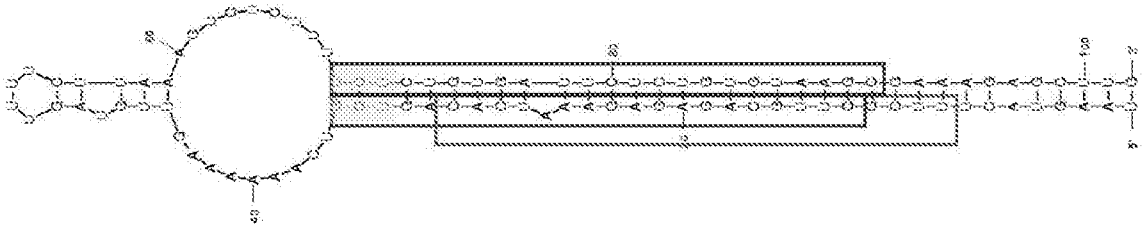

FIG. 12A
(a) AtmiR390
SEQ ID NO: 404
FIG. 12B
(b) SWAP5 (GFP)
SEQ ID NO: 405
FIG. 12C
(c) SWAP6 (GFP)
SEQ ID NO: 406
FIG. 12D
(d) SWAP7 (PDS3)
SEQ ID NO: 407
FIG. 12E
(e) SWAP8 (PDS3)
SEQ ID NO: 408
FIG. 12F
(f) SWAP11 (ADH1)
SEQ ID NO: 409
FIG. 12G
(g) SWAP12 (ADH1)
SEQ ID NO: 410

FIG. 13A

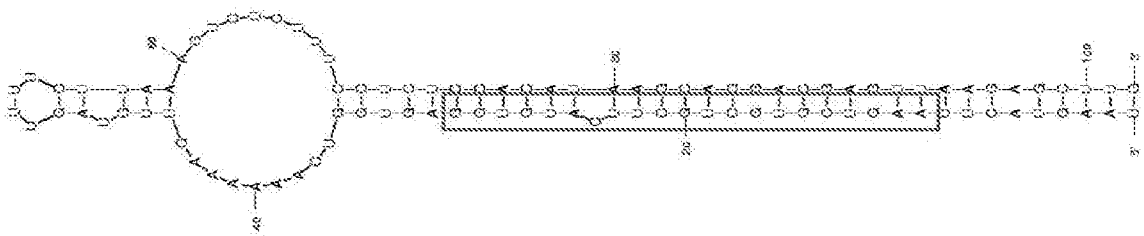
(a) AtmiR173



SEQ ID NO: 411

FIG. 13B

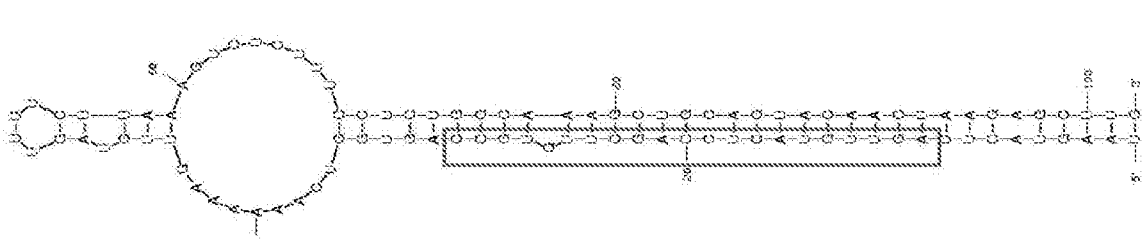
(b) SWAP1 (*GFP*)



SEQ ID NO: 412

FIG. 13C

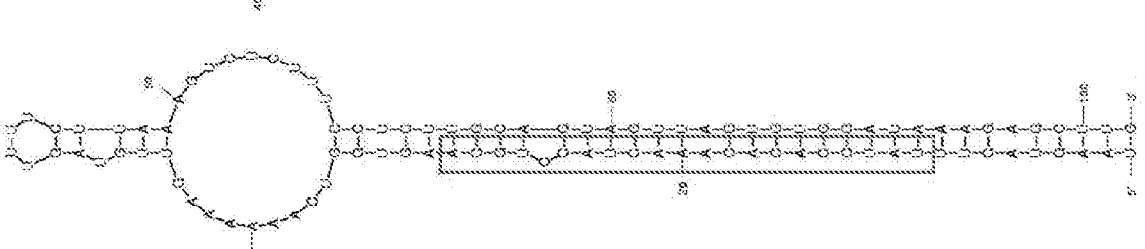
(c) SWAP2 (*GFP*)



SEQ ID NO: 413

FIG. 13D

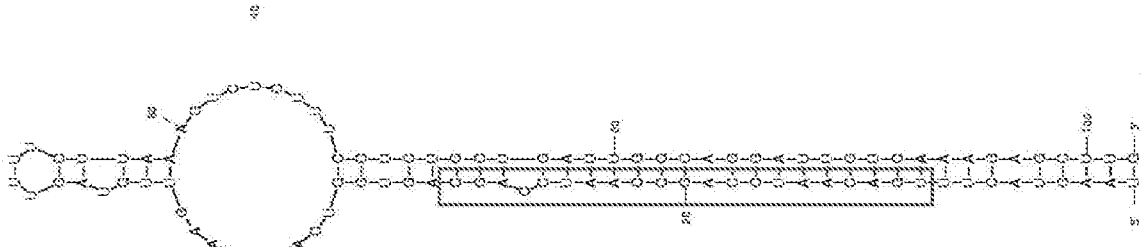
(d) SWAP3 (*PDS3*)



SEQ ID NO: 414

FIG. 13E

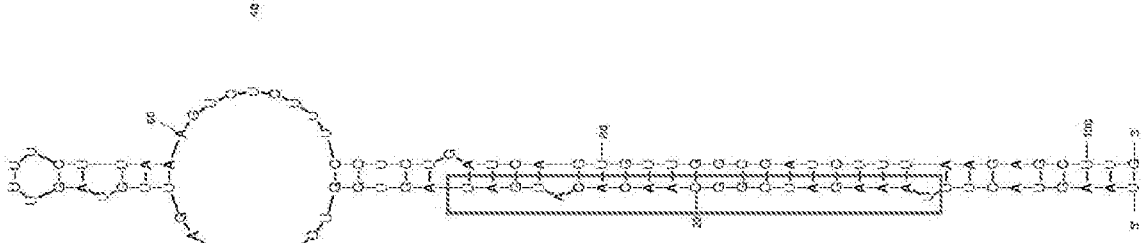
(e) SWAP4 (*PDS3*)



SEQ ID NO: 415

FIG. 13F

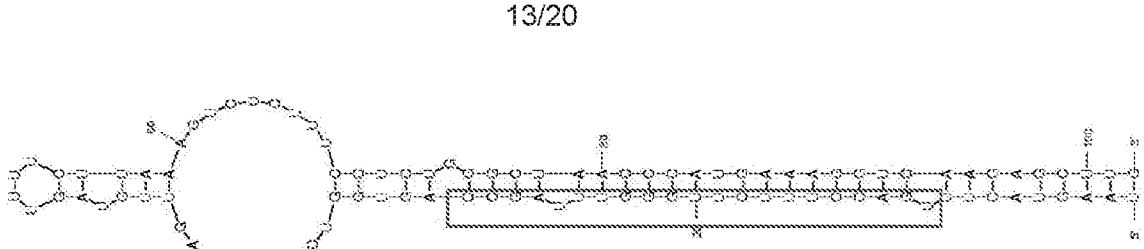
(f) SWAP9 (*ADH1*)



SEQ ID NO: 416

FIG. 13G

(g) SWAP10 (*ADH1*)



SEQ ID NO: 417

FIG. 13H

SEQ ID NO: 403
SEQ ID NO: 401
SEQ ID NO: 402
Wild-type
tasiRNA precursor
GEiGS-based
on tasiRNA precursor
(small nt change)
GEiGS-based
on tasiRNA precursor
(large nt change)

FIG. 14A

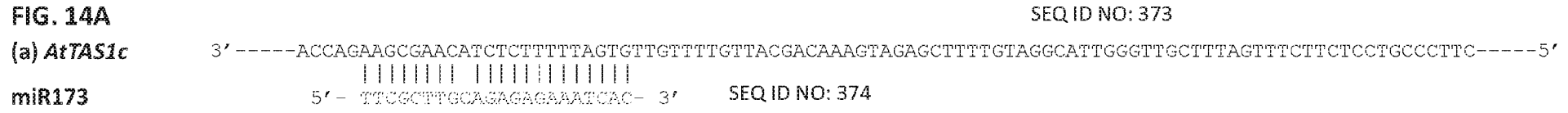


FIG. 14B

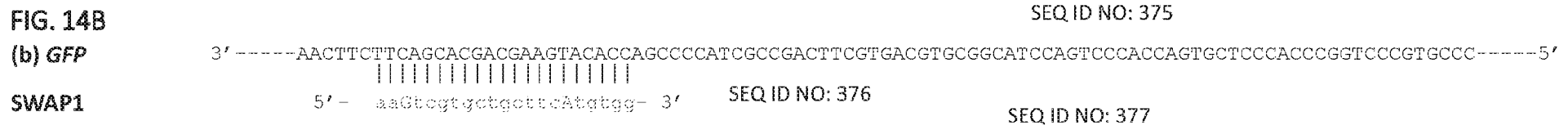


FIG. 14C

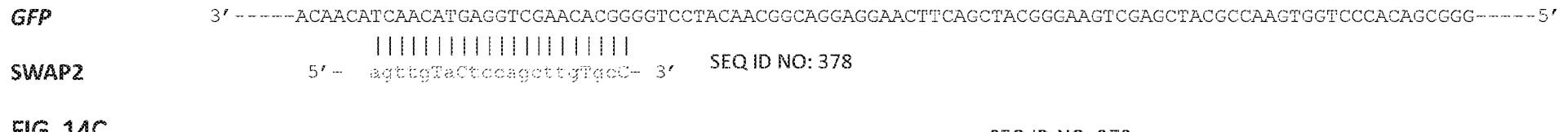


FIG. 14D

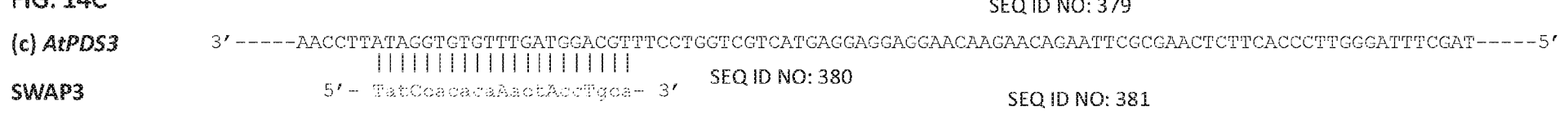


FIG. 15A

(a) *AtTAS3*

SEQ ID NO: 387

```
3'----------CTGATTTTCGAGTCTATCCTATTGTGGCGAAATAGTAACTTTGACCTTACGGCTTCTTTTTGAGTTACAGAGTCGTGTCGCCTAGGT----5'
                ||||||||||  |||||||||||||||||||||
          5'-   AAGCTCAGGAGGGATAACGCC-3'
```

SEQ ID NO: 388

miR390

FIG. 15B

SEQ ID NO: 389

(b) *GFP*

```
3'----------AACTTCTTCAGCACGACGAAGTACACCAGCCCCATCGCCGACTTCGTGACGTGCGGCATCCAGTCCCACCAGTGCTCCCACACCGGTC------5'
                ||||||||||||||||||||||||||||||||||||
          5'-   AAGtcgtGctGctcatGtgg-3'
```

SEQ ID NO: 390

SWAP5

SEQ ID NO: 391

GFP

```
3'----------ACAACATCAACATGAGGTCGAACACGGGGGTCCTACAACGGCAGGAGGAACTTCAGCTACGGGAAGTCGAGCTACGCCAAGTGGTCCC------5'
                ||||||||||||||||||||||||||||||||||||
          5'-   AgttgtActccaGctTgtGCC-3'
```

SEQ ID NO: 392

SWAP6

FIG. 15C

SEQ ID NO: 393

(c) *AtPDS3*

```
3'----------AACCTTATAGGTGTGTTTGATGCACGTTTCCTGGTCGTCATGAGGAGGAGGAACAAGAACAGAATTCGCGAACTCTTCACCCTTGGG----5'
                ||||||||||||||||||||||||||||||||||||
          5'-   tATCcaacaAaactactcttGCa-3'
```

SEQ ID NO: 394

SWAP7

SEQ ID NO: 395

AtPDS3

```
3'----------ACGTCAACTGTTAGGTCGGTTAGGTCGTGGTCGTTAATGTTGAAAGTTTCCGAATCGTCCTGCTCCTCGTGATGCCTTCCTACGTCT------5'
                ||||||||||||||||||||||||||||||||||||
          5'-   tgaCaaTccCAGccAaTccGagC-3'
```

SEQ ID NO: 396

SWAP8

SEQ ID NO: 397

FIG. 15D

(d) *AtADH1*

```
3'----------GAGGCCATTTCTAGCCGTTGTGTACTAGAGGACCGACTTCTAGTCAGTGAGGAAGAGGTTGTGAGAGTTGTTAGGGAGGTCGAAGTA----5'
                ||||||||||||||||||||||||||||||||||||
          5'-   tAaagatCGgcaacacatGat-  3'
```

SEQ ID NO: 398

SWAP11

SEQ ID NO: 399

AtADH1

```
3'----------TGTGAAACTGGAAAGAACCCAAATCGGTGTAAGTTTCAACGAGGATTGGGTCATCTGTTTGGTGTTGACTGTTATGTCTGGAACAGTTC----5'
                ||||||||||||||||||||||||||||||||||||
          5'-   tgaCttttctttGGgTTtagCC-  3'
```

SEQ ID NO: 400

SWAP12

FIG. 16

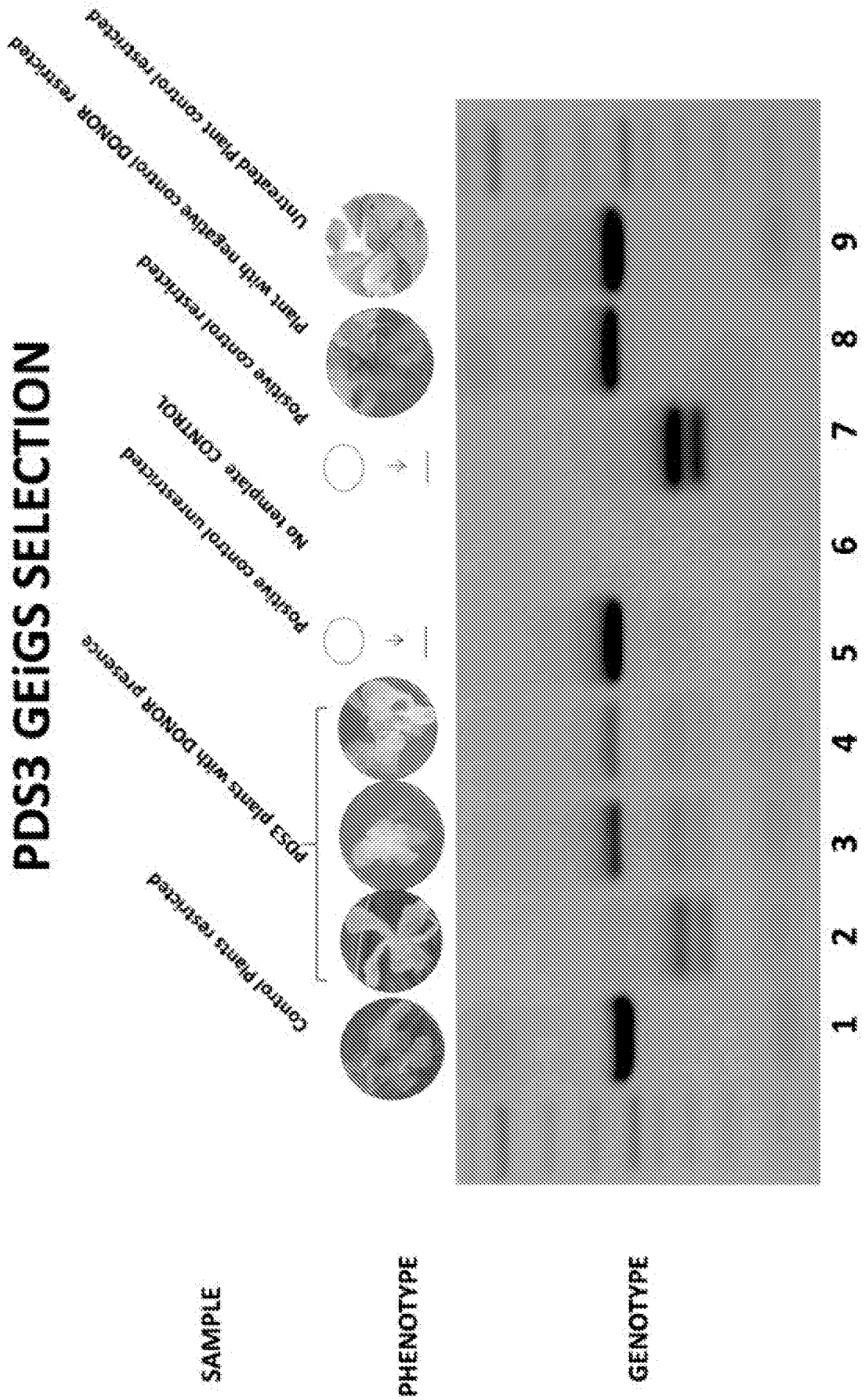

PDS3 GEiGS SELECTION
SAMPLE
PHENOTYPE
GENOTYPE
Control plants restricted
PDS3 plants with DONOR presence
Positive control unrestricted
No template CONTROL
Positive control restricted
Plant with negative control DONOR restricted
Untreated plant control restricted
1 2 3 4 5 6 7 8 9

FIG. 17

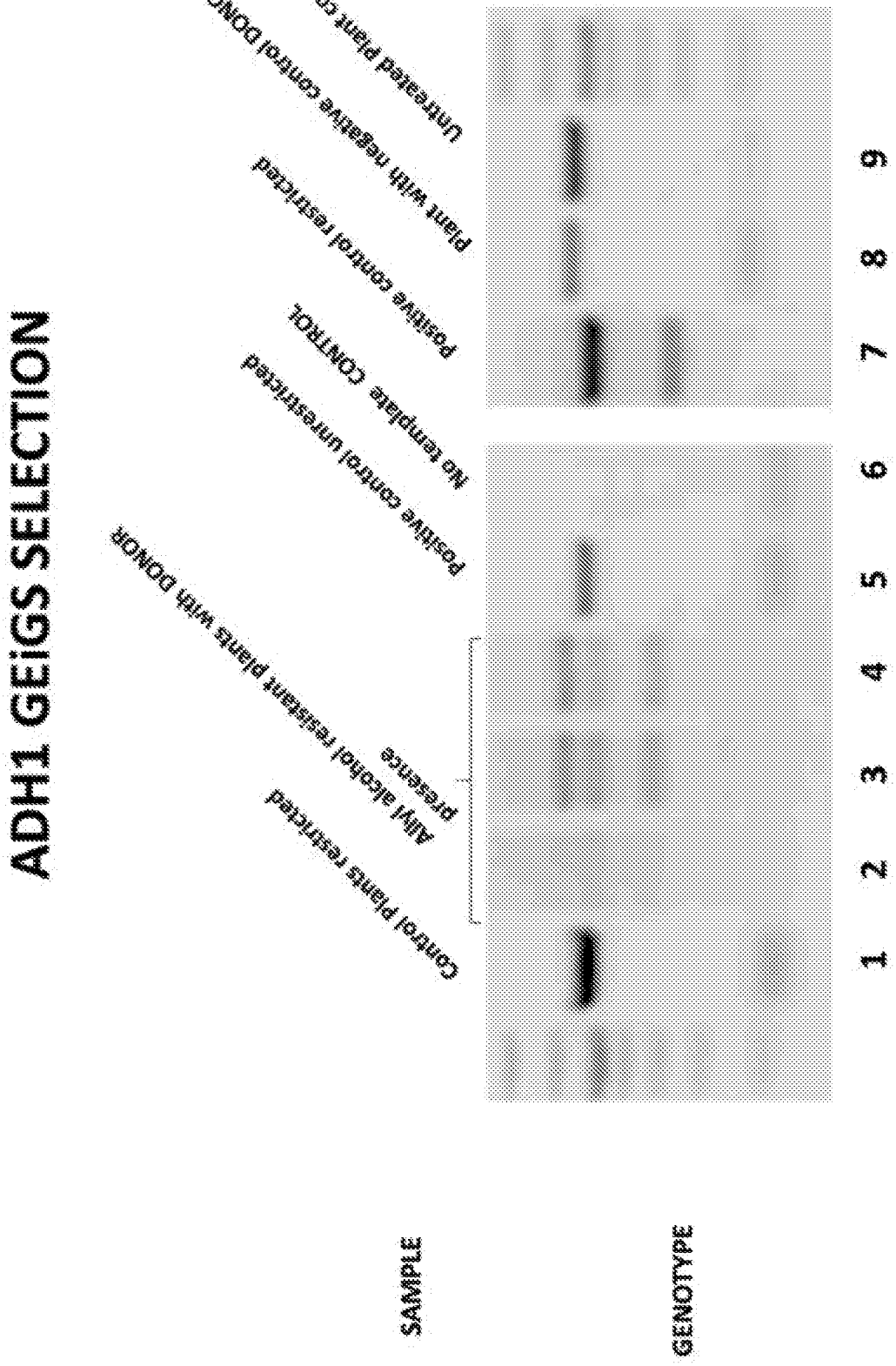

ADH1 GEiGS SELECTION
GENOTYPE
SAMPLE
1
2
3
4
5
6
7
8
9
Control plants restricted
AlwI alcohol resistant plants with DONOR presence
positive control unrestricted
No template CONTROL
positive control restricted
plant with negative control DONOR restricted
Untreated plant control restricted

FIG. 18

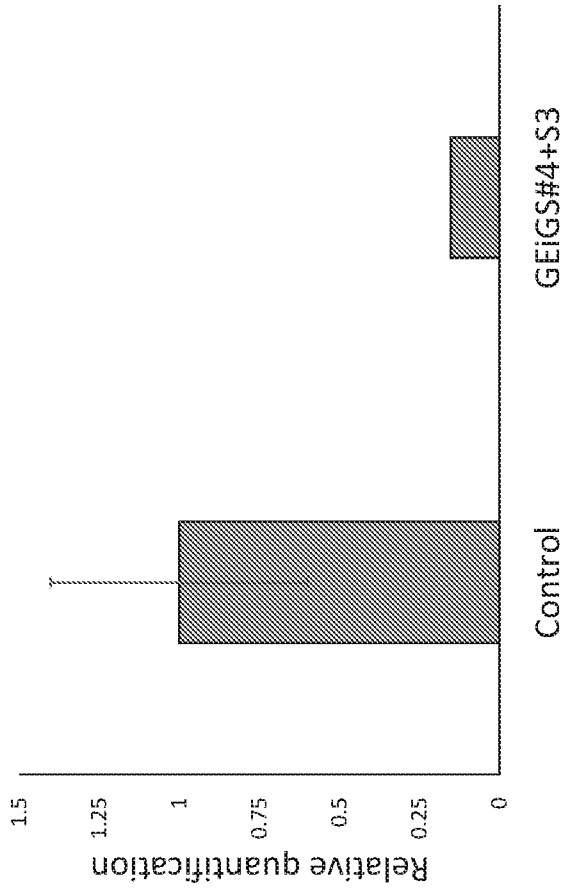
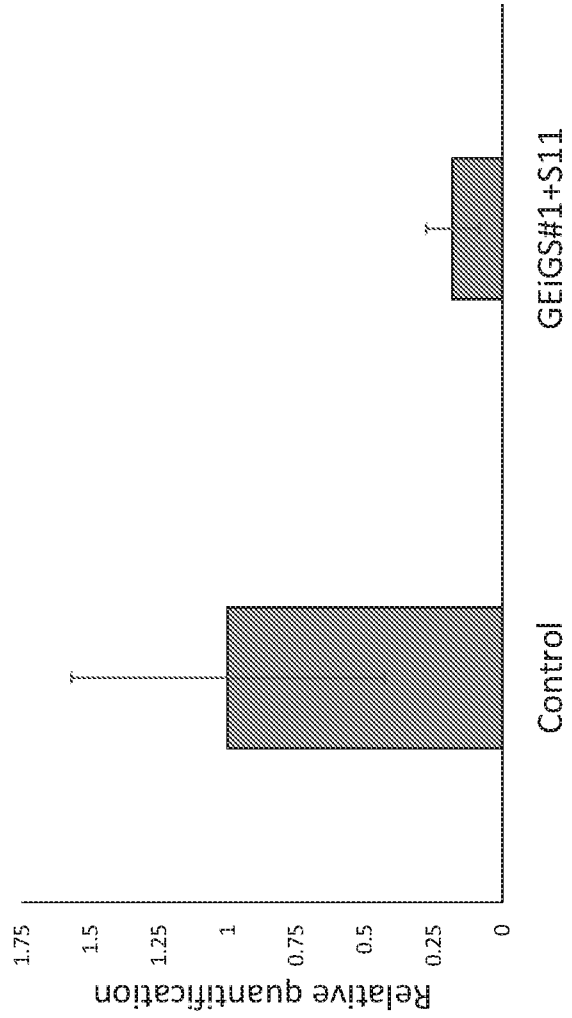

AtPDS3 expression in GEiGS#4+SWAP3 modified plant
Relative quantification
1.5
1.25
1
0.75
0.5
0.25
0
Control
GEiGS#4+S3

FIG. 19


AtADH1 expression in GEiGS#1+SWAP11 modified plant
Relative quantification
1.75
1.5
1.25
1
0.75
0.5
0.25
0
Control
GEiGS#1+S11