

10 Supplementary Material

10.1 Supplementary A: Comparison of captured and annotated ground truth images for dataset 1 and dataset 2.

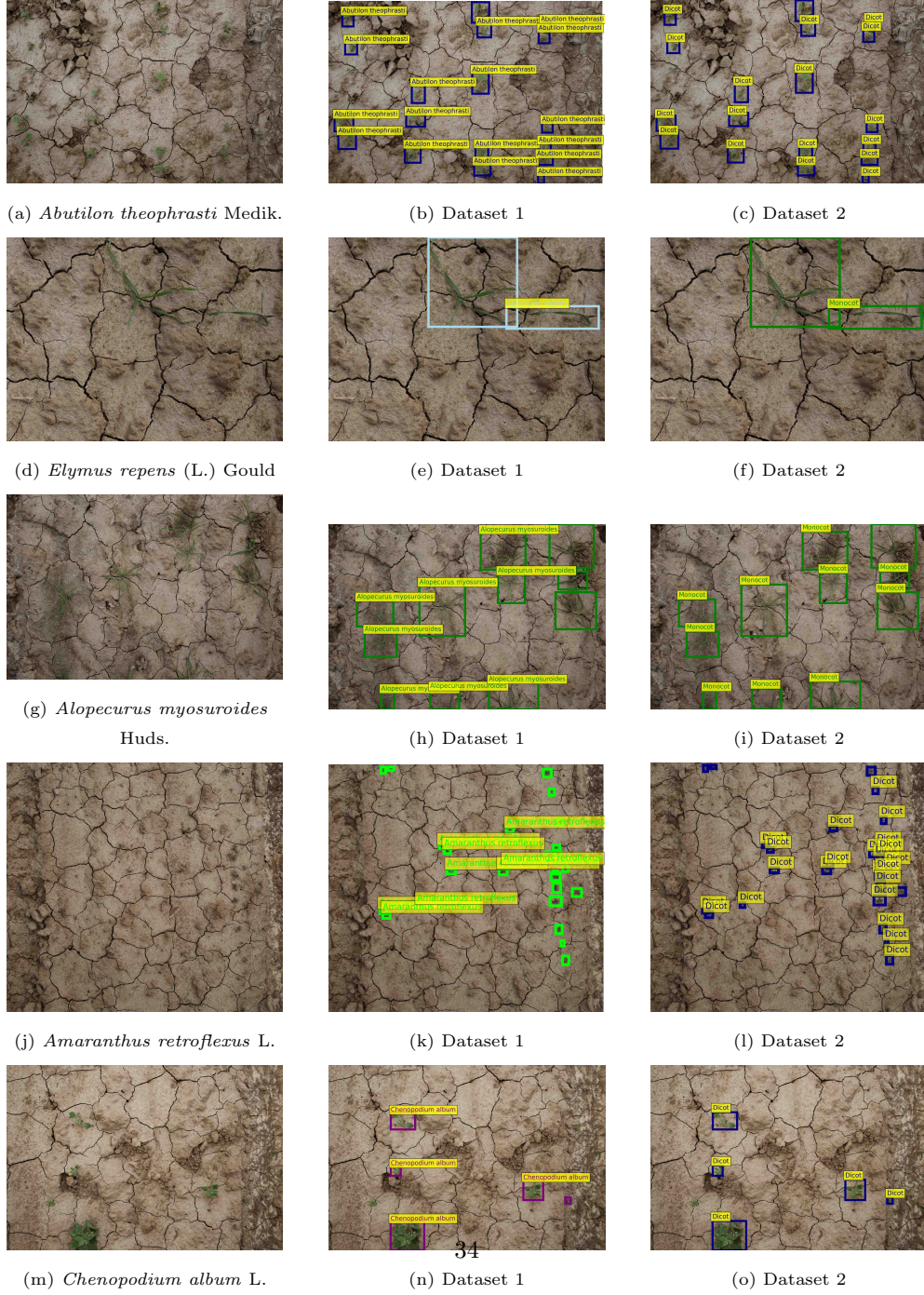
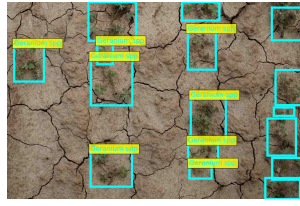


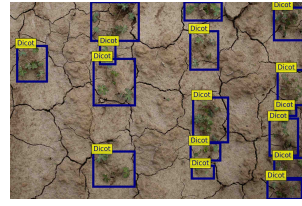
Fig. 4 Comparison of captured and annotated ground truth images for dataset 1 and dataset 2.



(a) *Geranium spp.*



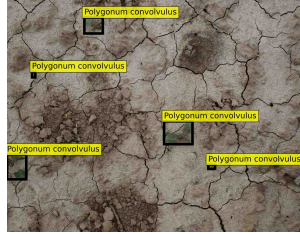
(b) Dataset 1



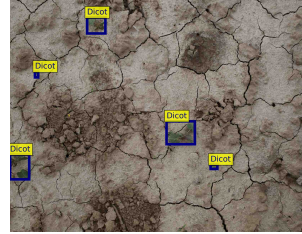
(c) Dataset 2



(d) *Fallopia convolvulus* (L.)
À. Löve



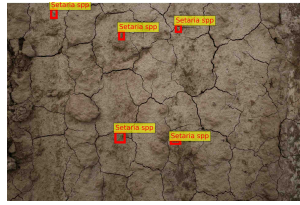
(e) Dataset 1



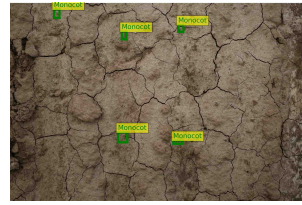
(f) Dataset 2



(g) *Setaria spp*



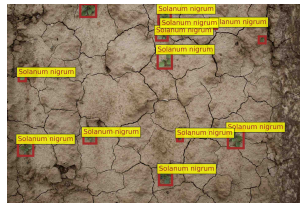
(h) Dataset 1



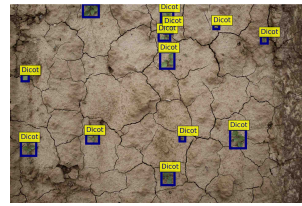
(i) Dataset 2



(j) *Solanum nigrum* L.



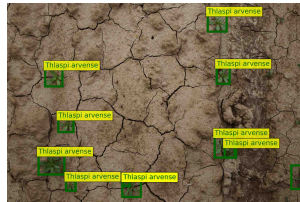
(k) Dataset 1



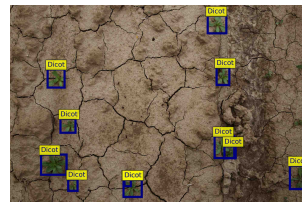
(l) Dataset 2



(m) *Thlaspi arvense* L.



(n) Dataset 1



(o) Dataset 2

Fig. 5 Comparison of captured and annotated ground truth images for dataset 1 and dataset 2.

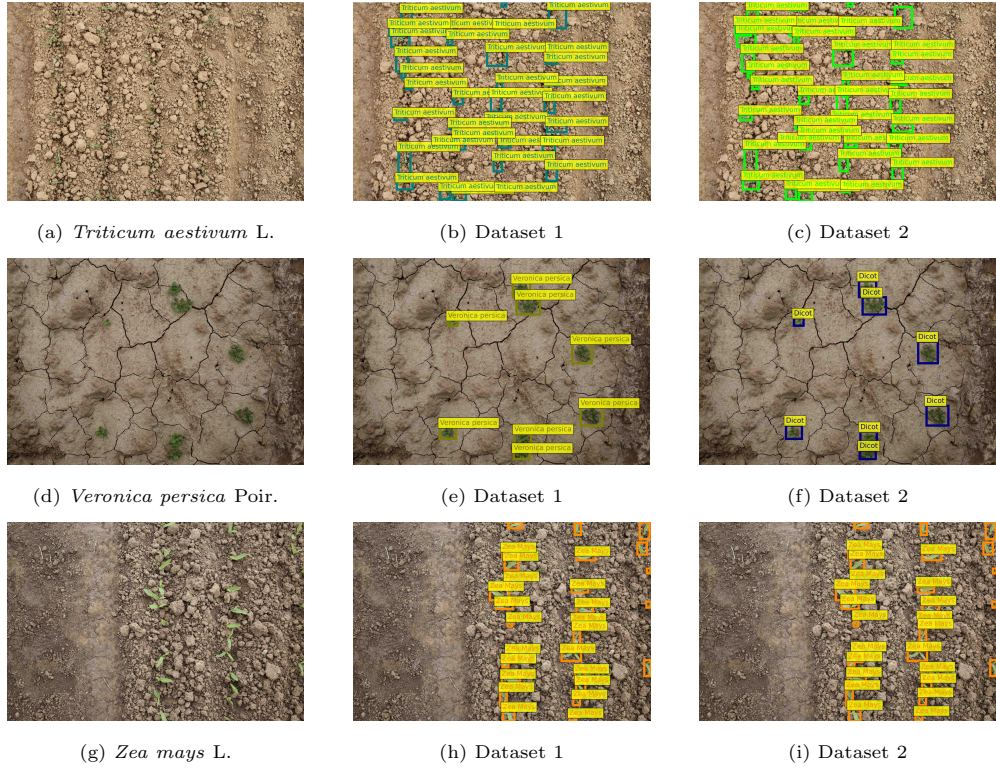


Fig. 6 Comparison of captured and annotated ground truth images for dataset 1 and dataset 2.

10.2 Supplementary B: Detailed Class-wise Results

10.2.1 Dataset 1

10.2.2 Performance of YOLOv8

Table 8 Performance of YOLOv8l for all species, across images and instances, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations ($\pm$ SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.14 $\pm$ 1.69	76.22 $\pm$ 1.82	80.18 $\pm$ 0.75	45.00 $\pm$ 0.77
<i>Elymus repens</i> (L.) Gould	53	309	72.28 $\pm$ 2.49	72.88 $\pm$ 1.62	75.08 $\pm$ 1.84	35.54 $\pm$ 0.38
<i>Alopecurus myosuroides</i> Huds.	77	635	91.64 $\pm$ 1.06	81.28 $\pm$ 0.81	88.26 $\pm$ 0.86	48.84 $\pm$ 1.33
<i>Amaranthus retroflexus</i> L.	94	418	87.20 $\pm$ 0.87	58.72 $\pm$ 0.71	68.94 $\pm$ 1.06	51.54 $\pm$ 1.23
<i>Avena fatua</i> L.	77	1131	81.56 $\pm$ 2.18	64.64 $\pm$ 1.09	74.52 $\pm$ 1.09	40.68 $\pm$ 1.15
<i>Chenopodium album</i> L.	101	329	76.44 $\pm$ 3.05	55.10 $\pm$ 1.55	65.04 $\pm$ 0.95	39.40 $\pm$ 0.46
<i>Geranium spp.</i>	53	1347	81.18 $\pm$ 0.78	56.54 $\pm$ 2.63	65.62 $\pm$ 2.91	30.86 $\pm$ 1.22
<i>Helianthus annuus</i> L.	56	1873	80.94 $\pm$ 2.02	75.36 $\pm$ 0.57	83.70 $\pm$ 1.23	60.86 $\pm$ 1.06
<i>Lamium purpureum</i> L.	214	1069	89.96 $\pm$ 1.55	57.72 $\pm$ 1.42	69.08 $\pm$ 1.21	40.08 $\pm$ 0.58
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	72.12 $\pm$ 4.46	58.62 $\pm$ 1.82	62.48 $\pm$ 1.40	44.64 $\pm$ 1.03
<i>Setaria spp.</i>	134	275	76.64 $\pm$ 4.70	41.14 $\pm$ 2.81	49.16 $\pm$ 2.10	29.22 $\pm$ 1.63
<i>Solanum nigrum</i> L.	57	331	79.26 $\pm$ 3.17	82.84 $\pm$ 1.40	86.12 $\pm$ 0.84	52.40 $\pm$ 1.19
<i>Thlaspi arvense</i> L.	273	1208	88.52 $\pm$ 1.71	51.46 $\pm$ 1.46	64.96 $\pm$ 0.55	42.16 $\pm$ 0.62
<i>Triticum aestivum</i> L.	58	1772	74.04 $\pm$ 1.92	66.86 $\pm$ 1.44	71.78 $\pm$ 1.94	31.76 $\pm$ 1.36
<i>Veronica persica</i> Poir.	108	322	86.24 $\pm$ 0.65	67.72 $\pm$ 1.32	72.70 $\pm$ 0.98	39.22 $\pm$ 1.23
<i>Zea mays</i> L.	65	1327	83.74 $\pm$ 1.24	77.64 $\pm$ 1.62	84.74 $\pm$ 0.91	51.44 $\pm$ 0.43

Table 9 Performance of YOLOv8m for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	74.62 $\pm$ 1.41	75.50 $\pm$ 1.83	78.48 $\pm$ 0.89	43.48 $\pm$ 1.21
<i>Elymus repens</i> (L.) Gould	53	309	68.76 $\pm$ 3.37	70.42 $\pm$ 2.20	71.76 $\pm$ 1.57	33.44 $\pm$ 1.90
<i>Alopecurus myosuroides</i> Huds.	77	635	87.14 $\pm$ 3.60	81.52 $\pm$ 0.50	86.72 $\pm$ 1.47	47.46 $\pm$ 1.69
<i>Amaranthus retroflexus</i> L.	94	418	86.94 $\pm$ 2.46	57.80 $\pm$ 1.60	68.40 $\pm$ 1.83	50.62 $\pm$ 1.72
<i>Avena fatua</i> L.	77	1131	78.84 $\pm$ 1.08	62.58 $\pm$ 2.31	72.04 $\pm$ 1.41	39.18 $\pm$ 1.15
<i>Chenopodium album</i> L.	101	329	79.06 $\pm$ 2.45	53.34 $\pm$ 1.70	65.06 $\pm$ 1.11	39.44 $\pm$ 0.67
<i>Geranium</i> spp.	53	1347	78.70 $\pm$ 1.93	58.10 $\pm$ 1.75	65.08 $\pm$ 1.68	29.96 $\pm$ 1.05
<i>Helianthus annuus</i> L.	56	1873	78.98 $\pm$ 1.27	75.68 $\pm$ 0.97	83.18 $\pm$ 1.05	60.60 $\pm$ 1.12
<i>Lamium purpureum</i> L.	214	1069	89.82 $\pm$ 1.78	58.38 $\pm$ 1.39	69.62 $\pm$ 0.45	40.64 $\pm$ 0.35
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	78.88 $\pm$ 4.70	55.30 $\pm$ 2.63	60.80 $\pm$ 0.89	42.42 $\pm$ 1.98
<i>Setaria</i> spp.	134	275	76.92 $\pm$ 3.78	41.02 $\pm$ 1.68	47.40 $\pm$ 2.59	27.48 $\pm$ 1.55
<i>Solanum nigrum</i> L.	57	331	78.04 $\pm$ 1.87	79.52 $\pm$ 2.17	83.50 $\pm$ 0.72	50.44 $\pm$ 0.47
<i>Thlaspi arvense</i> L.	273	1208	86.64 $\pm$ 2.04	52.00 $\pm$ 2.25	65.22 $\pm$ 1.34	41.84 $\pm$ 0.74
<i>Triticum aestivum</i> L.	58	1772	72.84 $\pm$ 1.49	67.60 $\pm$ 2.08	72.00 $\pm$ 0.80	32.26 $\pm$ 0.63
<i>Veronica persica</i> Poir.	108	322	85.66 $\pm$ 1.80	68.42 $\pm$ 1.12	72.52 $\pm$ 0.99	39.66 $\pm$ 1.15
<i>Zea mays</i> L.	65	1327	83.52 $\pm$ 1.00	77.98 $\pm$ 1.48	85.04 $\pm$ 1.24	51.44 $\pm$ 0.36

Table 10 Performance of YOLOv8s for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.96 ± 0.98	75.48 ± 2.76	79.22 ± 0.83	44.42 ± 0.96
<i>Elgynus repens</i> (L.) Gould	53	309	70.90 ± 1.75	73.88 ± 4.37	75.66 ± 1.66	34.86 ± 1.78
<i>Alopecurus myosuroides</i> Huds.	77	635	90.78 ± 0.83	81.92 ± 10.17	88.02 ± 0.15	48.92 ± 0.83
<i>Amaranthus retroflexus</i> L.	94	418	85.38 ± 2.24	58.76 ± 2.80	69.10 ± 1.05	50.92 ± 0.46
<i>Avena fatua</i> L.	77	1131	78.28 ± 1.06	65.60 ± 4.52	74.28 ± 1.52	40.20 ± 0.92
<i>Chenopodium album</i> L.	101	329	77.00 ± 1.89	55.62 ± 1.38	64.18 ± 1.02	39.78 ± 0.91
<i>Geranium spp.</i>	53	1347	81.22 ± 0.64	58.20 ± 7.30	66.58 ± 0.93	31.12 ± 0.36
<i>Helianthus annuus</i> L.	56	1873	79.32 ± 1.36	75.26 ± 7.58	83.76 ± 1.20	60.64 ± 1.13
<i>Lamium purpureum</i> L.	214	1069	90.38 ± 0.85	58.84 ± 1.24	69.36 ± 0.62	40.78 ± 0.67
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	71.64 ± 5.91	58.44 ± 9.36	61.34 ± 1.05	42.50 ± 1.18
<i>Setaria spp.</i>	134	275	75.06 ± 2.75	41.44 ± 16.09	47.88 ± 1.33	27.72 ± 0.67
<i>Solanum nigrum</i> L.	57	331	77.42 ± 3.16	79.90 ± 14.49	83.42 ± 0.82	49.98 ± 1.16
<i>Thlaspi arvense</i> L.	273	1208	87.16 ± 1.44	49.96 ± 6.57	64.48 ± 0.55	41.32 ± 0.28
<i>Triticum aestivum</i> L.	58	1772	74.24 ± 1.63	66.18 ± 0.77	71.40 ± 1.47	31.24 ± 0.89
<i>Veronica persica</i> Poir.	108	322	84.14 ± 1.76	67.96 ± 3.71	71.68 ± 1.36	39.98 ± 1.04
<i>Zea mays</i> L.	65	1327	85.34 ± 0.76	76.22 ± 0.62	84.68 ± 0.86	51.44 ± 0.40

Table 11 Performance of YOLOv8n for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	75.04 $\pm$ 1.28	74.44 $\pm$ 0.81	78.90 $\pm$ 0.53	44.04 $\pm$ 0.37
<i>Elymus repens</i> (L.) Gould	53	309	71.74 $\pm$ 2.22	72.24 $\pm$ 0.29	75.18 $\pm$ 2.15	34.62 $\pm$ 1.55
<i>Alopecurus myosuroides</i> Huds.	77	635	91.12 $\pm$ 0.56	81.02 $\pm$ 1.36	87.46 $\pm$ 0.47	48.30 $\pm$ 0.39
<i>Amaranthus retroflexus</i> L.	94	418	85.18 $\pm$ 1.57	59.28 $\pm$ 0.72	69.26 $\pm$ 0.86	50.98 $\pm$ 0.59
<i>Avena fatua</i> L.	77	1131	77.72 $\pm$ 1.56	65.18 $\pm$ 0.48	73.60 $\pm$ 0.97	39.56 $\pm$ 0.71
<i>Chenopodium album</i> L.	101	329	80.08 $\pm$ 1.52	53.08 $\pm$ 1.40	65.04 $\pm$ 0.86	39.94 $\pm$ 0.94
<i>Geranium</i> spp.	53	1347	81.82 $\pm$ 1.17	57.16 $\pm$ 0.74	66.22 $\pm$ 1.61	31.98 $\pm$ 0.82
<i>Helianthus annuus</i> L.	56	1873	78.56 $\pm$ 0.70	75.28 $\pm$ 0.71	84.18 $\pm$ 0.41	60.80 $\pm$ 0.37
<i>Lamium purpureum</i> L.	214	1069	90.06 $\pm$ 0.85	58.62 $\pm$ 0.50	68.98 $\pm$ 0.40	40.76 $\pm$ 0.51
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	65.06 $\pm$ 2.01	57.82 $\pm$ 1.19	60.70 $\pm$ 1.50	41.58 $\pm$ 0.76
<i>Setaria</i> spp.	134	275	79.22 $\pm$ 3.78	42.50 $\pm$ 2.81	50.70 $\pm$ 2.08	28.68 $\pm$ 1.18
<i>Solanum nigrum</i> L.	57	331	75.60 $\pm$ 1.91	77.82 $\pm$ 1.44	82.86 $\pm$ 0.84	50.72 $\pm$ 0.69
<i>Thlaspi arvense</i> L.	273	1208	86.72 $\pm$ 0.77	48.14 $\pm$ 0.89	63.40 $\pm$ 0.70	40.88 $\pm$ 0.42
<i>Triticum aestivum</i> L.	58	1772	74.90 $\pm$ 1.06	65.44 $\pm$ 0.34	72.80 $\pm$ 0.99	32.02 $\pm$ 0.64
<i>Veronica persica</i> Poir.	108	322	84.20 $\pm$ 1.14	66.00 $\pm$ 0.89	70.78 $\pm$ 0.79	39.90 $\pm$ 0.66
<i>Zea mays</i> L.	65	1327	84.72 $\pm$ 0.75	75.68 $\pm$ 0.90	84.88 $\pm$ 0.59	51.76 $\pm$ 0.53

10.2.3 Performance of YOLOv9

Table 12 Performance of YOLOv9e for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.86 $\pm$ 0.99	77.80 $\pm$ 0.64	80.32 $\pm$ 0.55	45.90 $\pm$ 0.82
<i>Elymus repens</i> (L.) Gould	53	309	71.30 $\pm$ 2.24	75.28 $\pm$ 2.42	77.26 $\pm$ 2.47	37.36 $\pm$ 1.64
<i>Alopecurus myosuroides</i> Huds.	77	635	91.66 $\pm$ 0.77	82.10 $\pm$ 1.13	88.30 $\pm$ 0.78	49.34 $\pm$ 1.19
<i>Amaranthus retroflexus</i> L.	94	418	86.04 $\pm$ 1.57	59.34 $\pm$ 1.01	68.90 $\pm$ 0.48	51.84 $\pm$ 0.81
<i>Avena fatua</i> L.	77	1131	79.38 $\pm$ 1.58	65.34 $\pm$ 0.63	74.28 $\pm$ 0.22	40.68 $\pm$ 0.51
<i>Chenopodium album</i> L.	101	329	77.70 $\pm$ 2.67	56.54 $\pm$ 1.27	66.34 $\pm$ 1.94	39.80 $\pm$ 1.36
<i>Geranium spp.</i>	53	1347	79.94 $\pm$ 1.22	59.18 $\pm$ 1.05	66.34 $\pm$ 1.54	31.28 $\pm$ 0.82
<i>Helianthus annuus</i> L.	56	1873	79.38 $\pm$ 1.54	75.62 $\pm$ 1.58	83.48 $\pm$ 1.89	60.90 $\pm$ 1.59
<i>Lamium purpureum</i> L.	214	1069	90.64 $\pm$ 1.37	58.24 $\pm$ 0.69	69.84 $\pm$ 0.94	40.76 $\pm$ 0.74
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	81.96 $\pm$ 3.38	58.30 $\pm$ 1.35	63.50 $\pm$ 0.69	46.86 $\pm$ 1.10
<i>Setaria spp.</i>	134	275	79.78 $\pm$ 1.57	44.74 $\pm$ 1.52	52.28 $\pm$ 1.68	32.04 $\pm$ 0.48
<i>Solanum nigrum</i> L.	57	331	81.10 $\pm$ 2.94	82.84 $\pm$ 1.53	86.14 $\pm$ 0.91	51.30 $\pm$ 0.90
<i>Thlaspi arvense</i> L.	273	1208	86.18 $\pm$ 2.03	52.98 $\pm$ 0.98	65.90 $\pm$ 1.17	42.74 $\pm$ 0.38
<i>Triticum aestivum</i> L.	58	1772	73.94 $\pm$ 1.03	65.68 $\pm$ 1.28	71.06 $\pm$ 1.20	31.34 $\pm$ 0.65
<i>Veronica persica</i> Poir.	108	322	83.90 $\pm$ 1.72	68.46 $\pm$ 1.38	72.28 $\pm$ 0.45	39.20 $\pm$ 1.02
<i>Zea mays</i> L.	65	1327	84.02 $\pm$ 0.56	78.08 $\pm$ 1.01	84.70 $\pm$ 0.49	51.78 $\pm$ 0.58

Table 13 Performance of YOLOv9c for all species, across images and instances, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values..

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	74.96 ± 1.47	76.02 ± 0.40	79.30 ± 1.42	44.38 ± 1.21
<i>Elymus repens</i> (L.) Gould	53	309	69.70 ± 2.14	72.48 ± 4.04	74.42 ± 2.38	35.52 ± 1.81
<i>Alopecurus myosuroides</i> Huds.	77	635	91.54 ± 0.94	82.70 ± 0.94	88.64 ± 0.69	49.36 ± 1.45
<i>Amaranthus retroflexus</i> L.	94	418	84.44 ± 1.23	60.46 ± 1.90	69.58 ± 1.30	51.74 ± 0.84
<i>Avena fatua</i> L.	77	1131	76.58 ± 2.49	65.44 ± 1.43	73.46 ± 1.21	40.42 ± 0.82
<i>Chenopodium album</i> L.	101	329	77.00 ± 3.42	58.62 ± 2.50	67.68 ± 1.47	41.08 ± 1.08
<i>Geranium</i> spp.	53	1347	81.30 ± 2.07	59.46 ± 1.65	68.70 ± 1.92	32.60 ± 1.04
<i>Helianthus annuus</i> L.	56	1873	80.54 ± 1.91	75.84 ± 0.84	84.60 ± 0.91	61.78 ± 0.45
<i>Lamium purpureum</i> L.	214	1069	89.26 ± 1.70	58.24 ± 1.93	70.50 ± 1.18	41.36 ± 0.77
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	74.30 ± 5.58	57.56 ± 3.17	61.44 ± 2.05	42.94 ± 1.91
<i>Setaria</i> spp.	134	275	76.82 ± 3.49	42.18 ± 2.29	50.18 ± 2.37	30.62 ± 0.93
<i>Solanum nigrum</i> L.	57	331	78.40 ± 4.61	81.96 ± 1.19	85.50 ± 0.99	51.24 ± 0.59
<i>Thlaspi arvense</i> L.	273	1208	88.64 ± 1.11	51.96 ± 1.21	66.76 ± 1.37	43.12 ± 0.64
<i>Triticum aestivum</i> L.	58	1772	74.60 ± 2.90	67.08 ± 1.30	73.32 ± 2.04	32.72 ± 1.41
<i>Veronica persica</i> Poir.	108	322	85.06 ± 2.94	68.04 ± 0.63	72.24 ± 1.59	40.10 ± 1.08
<i>Zea mays</i> L.	65	1327	83.90 ± 1.27	77.02 ± 1.22	84.58 ± 0.72	51.60 ± 1.22

Table 14 Performance of YOLOv9m for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	74.12 $\pm$ 1.49	76.36 $\pm$ 1.85	79.08 $\pm$ 0.67	45.08 $\pm$ 0.83
<i>Elymus repens</i> (L.) Gould	53	309	68.90 $\pm$ 2.51	74.14 $\pm$ 2.15	75.32 $\pm$ 3.18	36.12 $\pm$ 1.58
<i>Alopecurus myosuroides</i> Huds.	77	635	90.30 $\pm$ 1.61	82.26 $\pm$ 1.17	87.88 $\pm$ 0.37	49.60 $\pm$ 0.78
<i>Amaranthus retroflexus</i> L.	94	418	86.32 $\pm$ 0.78	59.52 $\pm$ 1.26	69.96 $\pm$ 1.71	52.18 $\pm$ 1.55
<i>Avena fatua</i> L.	77	1131	78.16 $\pm$ 1.04	65.84 $\pm$ 1.18	74.32 $\pm$ 0.99	40.76 $\pm$ 0.64
<i>Chenopodium album</i> L.	101	329	78.16 $\pm$ 3.56	57.20 $\pm$ 1.78	66.82 $\pm$ 1.54	40.76 $\pm$ 1.15
<i>Geranium spp.</i>	53	1347	79.48 $\pm$ 0.86	60.06 $\pm$ 0.98	66.96 $\pm$ 1.27	31.90 $\pm$ 0.58
<i>Helianthus annuus</i> L.	56	1873	79.34 $\pm$ 1.68	75.38 $\pm$ 1.58	83.80 $\pm$ 1.25	61.50 $\pm$ 1.00
<i>Lamium purpureum</i> L.	214	1069	90.82 $\pm$ 0.87	58.84 $\pm$ 0.59	70.66 $\pm$ 0.87	41.40 $\pm$ 0.74
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	75.18 $\pm$ 6.00	57.36 $\pm$ 2.48	62.16 $\pm$ 0.71	45.04 $\pm$ 0.63
<i>Setaria spp.</i>	134	275	77.48 $\pm$ 3.99	42.06 $\pm$ 2.79	50.10 $\pm$ 1.56	30.62 $\pm$ 0.69
<i>Solanum nigrum</i> L.	57	331	81.78 $\pm$ 1.64	79.82 $\pm$ 1.36	85.50 $\pm$ 0.83	52.12 $\pm$ 0.66
<i>Thlaspi arvense</i> L.	273	1208	87.08 $\pm$ 1.53	53.12 $\pm$ 1.23	66.08 $\pm$ 0.36	42.46 $\pm$ 0.38
<i>Triticum aestivum</i> L.	58	1772	73.56 $\pm$ 1.32	68.22 $\pm$ 1.74	72.52 $\pm$ 1.52	32.42 $\pm$ 1.19
<i>Veronica persica</i> Poir.	108	322	85.52 $\pm$ 2.45	68.64 $\pm$ 0.80	71.68 $\pm$ 1.26	39.50 $\pm$ 0.80
<i>Zea mays</i> L.	65	1327	83.76 $\pm$ 1.28	77.30 $\pm$ 1.29	84.54 $\pm$ 0.75	51.52 $\pm$ 0.94

Table 15 Performance of YOLOv9s for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	73.76 $\pm$ 1.28	77.88 $\pm$ 0.90	79.38 $\pm$ 0.73	45.22 $\pm$ 0.80
<i>Elymus repens</i> (L.) Gould	53	309	73.52 $\pm$ 2.39	75.76 $\pm$ 1.91	78.00 $\pm$ 1.76	37.16 $\pm$ 1.62
<i>Alopecurus myosuroides</i> Huds.	77	635	91.84 $\pm$ 1.29	83.12 $\pm$ 0.90	89.08 $\pm$ 0.93	50.60 $\pm$ 0.91
<i>Amaranthus retroflexus</i> L.	94	418	85.98 $\pm$ 1.60	59.86 $\pm$ 1.63	70.86 $\pm$ 1.75	52.58 $\pm$ 0.96
<i>Avena fatua</i> L.	77	1131	78.32 $\pm$ 1.13	67.64 $\pm$ 0.47	75.28 $\pm$ 0.73	41.82 $\pm$ 0.77
<i>Chenopodium album</i> L.	101	329	78.94 $\pm$ 2.98	56.66 $\pm$ 0.65	67.28 $\pm$ 1.60	41.16 $\pm$ 1.10
<i>Geranium</i> spp.	53	1347	80.76 $\pm$ 1.15	58.96 $\pm$ 1.40	66.24 $\pm$ 1.59	31.48 $\pm$ 1.02
<i>Helianthus annuus</i> L.	56	1873	79.90 $\pm$ 0.41	75.34 $\pm$ 0.68	83.92 $\pm$ 0.70	61.34 $\pm$ 0.92
<i>Lamium purpureum</i> L.	214	1069	90.60 $\pm$ 1.06	58.98 $\pm$ 0.23	69.76 $\pm$ 0.90	41.00 $\pm$ 0.90
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	75.26 $\pm$ 4.88	59.28 $\pm$ 2.14	61.66 $\pm$ 0.93	46.42 $\pm$ 1.37
<i>Setaria</i> spp.	134	275	78.16 $\pm$ 3.04	44.72 $\pm$ 0.78	52.28 $\pm$ 1.24	32.88 $\pm$ 0.95
<i>Solanum nigrum</i> L.	57	331	80.38 $\pm$ 2.83	81.92 $\pm$ 1.85	85.98 $\pm$ 1.04	52.50 $\pm$ 1.08
<i>Thlaspi arvense</i> L.	273	1208	87.56 $\pm$ 1.36	51.96 $\pm$ 1.44	65.00 $\pm$ 1.34	41.78 $\pm$ 0.68
<i>Triticum aestivum</i> L.	58	1772	75.84 $\pm$ 1.18	67.60 $\pm$ 0.54	74.42 $\pm$ 0.82	33.08 $\pm$ 0.43
<i>Veronica persica</i> Poir.	108	322	83.46 $\pm$ 1.81	68.64 $\pm$ 0.87	72.46 $\pm$ 1.30	40.62 $\pm$ 0.81
<i>Zea mays</i> L.	65	1327	84.56 $\pm$ 0.73	77.18 $\pm$ 1.05	84.72 $\pm$ 0.24	51.58 $\pm$ 0.44

Table 16 Performance of YOLOv9t for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.76 $\pm$ 0.95	75.48 $\pm$ 0.99	80.24 $\pm$ 0.59	45.00 $\pm$ 0.50
<i>Elymus repens</i> (L.) Gould	53	309	77.64 $\pm$ 2.59	76.18 $\pm$ 2.49	79.62 $\pm$ 1.81	38.12 $\pm$ 0.61
<i>Alopecurus myosuroides</i> Huds.	77	635	91.78 $\pm$ 0.53	81.80 $\pm$ 0.83	88.44 $\pm$ 0.54	50.46 $\pm$ 0.45
<i>Amaranthus retroflexus</i> L.	94	418	83.42 $\pm$ 2.10	59.92 $\pm$ 1.85	70.88 $\pm$ 0.82	52.70 $\pm$ 0.94
<i>Avena fatua</i> L.	77	1131	78.74 $\pm$ 0.97	67.86 $\pm$ 0.86	74.84 $\pm$ 0.57	40.40 $\pm$ 0.31
<i>Chenopodium album</i> L.	101	329	83.36 $\pm$ 2.42	53.16 $\pm$ 0.86	66.60 $\pm$ 0.89	41.24 $\pm$ 0.36
<i>Geranium</i> spp.	53	1347	81.60 $\pm$ 1.23	57.54 $\pm$ 0.77	66.16 $\pm$ 0.83	32.12 $\pm$ 0.66
<i>Helianthus annuus</i> L.	56	1873	78.30 $\pm$ 1.67	75.32 $\pm$ 0.23	83.90 $\pm$ 0.72	61.16 $\pm$ 0.42
<i>Lamium purpureum</i> L.	214	1069	89.36 $\pm$ 0.75	57.80 $\pm$ 0.81	68.34 $\pm$ 0.62	41.02 $\pm$ 0.33
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	73.62 $\pm$ 4.61	58.24 $\pm$ 1.55	61.04 $\pm$ 1.05	45.50 $\pm$ 0.62
<i>Setaria</i> spp.	134	275	79.62 $\pm$ 1.83	45.56 $\pm$ 1.26	54.24 $\pm$ 1.07	33.44 $\pm$ 0.41
<i>Solanum nigrum</i> L.	57	331	80.22 $\pm$ 0.94	80.40 $\pm$ 1.54	85.90 $\pm$ 0.54	53.12 $\pm$ 0.26
<i>Thlaspi arvense</i> L.	273	1208	84.42 $\pm$ 0.72	50.44 $\pm$ 0.47	62.10 $\pm$ 0.86	40.34 $\pm$ 0.72
<i>Triticum aestivum</i> L.	58	1772	75.20 $\pm$ 0.66	66.12 $\pm$ 1.10	73.14 $\pm$ 0.44	32.90 $\pm$ 0.50
<i>Veronica persica</i> Poir.	108	322	81.70 $\pm$ 2.61	68.88 $\pm$ 1.23	72.08 $\pm$ 0.57	41.32 $\pm$ 0.53
<i>Zea mays</i> L.	65	1327	83.68 $\pm$ 1.29	77.20 $\pm$ 1.05	85.56 $\pm$ 0.73	52.08 $\pm$ 0.38

10.2.4 Performance of YOLOv10

Table 17 Performance of YOLOv10x for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	77.32 $\pm$ 1.78	74.90 $\pm$ 1.66	80.14 $\pm$ 1.31	45.76 $\pm$ 1.76
<i>Elymus repens</i> (L.) Gould	53	309	71.66 $\pm$ 2.00	72.94 $\pm$ 1.80	75.08 $\pm$ 0.49	36.34 $\pm$ 0.39
<i>Alopecurus myosuroides</i> Huds.	77	635	90.10 $\pm$ 2.10	82.86 $\pm$ 0.82	88.26 $\pm$ 0.54	49.50 $\pm$ 1.38
<i>Amaranthus retroflexus</i> L.	94	418	85.20 $\pm$ 1.96	58.30 $\pm$ 1.32	68.60 $\pm$ 1.00	51.28 $\pm$ 0.48
<i>Avena fatua</i> L.	77	1131	78.88 $\pm$ 1.35	66.30 $\pm$ 1.04	73.52 $\pm$ 0.61	41.34 $\pm$ 0.99
<i>Chenopodium album</i> L.	101	329	81.62 $\pm$ 3.27	56.34 $\pm$ 1.34	66.72 $\pm$ 0.54	40.72 $\pm$ 0.51
<i>Geranium</i> spp.	53	1347	79.90 $\pm$ 2.33	57.56 $\pm$ 0.76	66.86 $\pm$ 2.23	31.86 $\pm$ 1.42
<i>Helianthus annuus</i> L.	56	1873	80.54 $\pm$ 1.22	74.82 $\pm$ 0.82	83.00 $\pm$ 0.75	60.82 $\pm$ 0.61
<i>Lamium purpureum</i> L.	214	1069	89.44 $\pm$ 1.09	57.18 $\pm$ 0.70	67.38 $\pm$ 0.86	39.60 $\pm$ 1.23
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	76.06 $\pm$ 7.56	57.34 $\pm$ 1.78	61.82 $\pm$ 2.79	44.14 $\pm$ 1.15
<i>Setaria</i> spp.	134	275	77.40 $\pm$ 1.23	45.32 $\pm$ 2.00	50.56 $\pm$ 1.11	30.82 $\pm$ 1.28
<i>Solanum nigrum</i> L.	57	331	80.52 $\pm$ 2.79	86.64 $\pm$ 1.28	89.16 $\pm$ 0.82	54.50 $\pm$ 0.70
<i>Thlaspi arvense</i> L.	273	1208	89.28 $\pm$ 0.41	51.46 $\pm$ 1.26	63.92 $\pm$ 0.88	41.86 $\pm$ 0.40
<i>Triticum aestivum</i> L.	58	1772	75.58 $\pm$ 2.21	66.62 $\pm$ 0.86	71.88 $\pm$ 1.14	32.02 $\pm$ 0.83
<i>Veronica persica</i> Poir.	108	322	83.90 $\pm$ 1.74	67.88 $\pm$ 2.29	72.22 $\pm$ 1.27	38.92 $\pm$ 0.75
<i>Zea mays</i> L.	65	1327	83.56 $\pm$ 1.46	76.70 $\pm$ 0.63	84.24 $\pm$ 0.51	51.88 $\pm$ 0.27

Table 18 Performance of YOLOv10l for all species, across images and instances, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.42 $\pm$ 1.66	75.62 $\pm$ 1.33	80.26 $\pm$ 0.61	45.90 $\pm$ 0.43
<i>Elymus repens</i> (L.) Gould	53	309	70.98 $\pm$ 2.21	72.78 $\pm$ 2.41	74.92 $\pm$ 2.27	35.76 $\pm$ 1.31
<i>Alopecurus myosuroides</i> Huds.	77	635	90.44 $\pm$ 1.32	82.58 $\pm$ 1.38	87.96 $\pm$ 1.02	49.22 $\pm$ 0.91
<i>Amaranthus retroflexus</i> L.	94	418	85.98 $\pm$ 0.84	58.26 $\pm$ 1.75	68.96 $\pm$ 1.16	51.36 $\pm$ 0.85
<i>Avena fatua</i> L.	77	1131	79.14 $\pm$ 2.25	65.74 $\pm$ 1.90	73.02 $\pm$ 1.16	40.14 $\pm$ 0.62
<i>Chenopodium album</i> L.	101	329	81.66 $\pm$ 3.49	56.32 $\pm$ 1.07	67.44 $\pm$ 2.00	41.00 $\pm$ 1.41
<i>Geranium</i> spp.	53	1347	79.36 $\pm$ 1.91	57.16 $\pm$ 2.23	66.20 $\pm$ 2.56	31.08 $\pm$ 0.75
<i>Helianthus annuus</i> L.	56	1873	80.46 $\pm$ 1.57	73.90 $\pm$ 1.08	81.94 $\pm$ 0.71	60.00 $\pm$ 0.54
<i>Lamium purpureum</i> L.	214	1069	90.20 $\pm$ 1.00	57.34 $\pm$ 0.60	67.72 $\pm$ 0.78	39.68 $\pm$ 0.74
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	77.32 $\pm$ 5.85	57.66 $\pm$ 1.99	62.24 $\pm$ 2.55	44.34 $\pm$ 1.73
<i>Setaria</i> spp.	134	275	77.86 $\pm$ 2.71	43.50 $\pm$ 1.71	49.28 $\pm$ 1.01	30.24 $\pm$ 1.27
<i>Solanum nigrum</i> L.	57	331	80.88 $\pm$ 2.34	84.78 $\pm$ 0.97	89.18 $\pm$ 0.68	54.24 $\pm$ 1.51
<i>Thlaspi arvense</i> L.	273	1208	89.62 $\pm$ 1.39	51.52 $\pm$ 0.79	64.08 $\pm$ 0.57	41.74 $\pm$ 0.51
<i>Triticum aestivum</i> L.	58	1772	76.94 $\pm$ 1.35	66.26 $\pm$ 1.13	72.48 $\pm$ 1.16	32.20 $\pm$ 0.97
<i>Veronica persica</i> Poir.	108	322	85.38 $\pm$ 2.65	67.34 $\pm$ 1.13	72.32 $\pm$ 1.56	39.02 $\pm$ 1.45
<i>Zea mays</i> L.	65	1327	84.68 $\pm$ 0.88	77.60 $\pm$ 1.55	84.64 $\pm$ 0.65	51.84 $\pm$ 0.50

Table 19 Performance of YOLOv10m for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.22 ± 0.91	75.68 ± 0.85	79.94 ± 0.45	45.18 ± 0.71
<i>Elymus repens</i> (L.) Gould	53	309	71.68 ± 2.55	71.16 ± 1.86	74.56 ± 1.17	34.72 ± 1.06
<i>Alopecurus myosuroides</i> Huds.	77	635	90.18 ± 0.68	82.62 ± 0.88	88.32 ± 0.76	49.92 ± 0.83
<i>Amaranthus retroflexus</i> L.	94	418	86.38 ± 0.97	57.52 ± 2.06	68.48 ± 1.31	51.76 ± 0.99
<i>Avena fatua</i> L.	77	1131	80.10 ± 1.41	65.20 ± 0.90	73.54 ± 0.85	40.38 ± 0.48
<i>Chenopodium album</i> L.	101	329	78.40 ± 2.44	55.96 ± 1.24	66.70 ± 0.92	40.66 ± 0.93
<i>Geranium</i> spp.	53	1347	79.04 ± 1.54	57.18 ± 0.98	66.20 ± 1.18	31.90 ± 1.18
<i>Helianthus annuus</i> L.	56	1873	80.36 ± 0.94	73.96 ± 0.34	82.62 ± 1.15	60.58 ± 0.93
<i>Lamium purpureum</i> L.	214	1069	90.24 ± 1.10	57.26 ± 1.20	67.74 ± 0.90	40.04 ± 0.81
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	71.72 ± 5.51	57.74 ± 1.42	60.32 ± 1.54	43.24 ± 1.94
<i>Setaria</i> spp.	134	275	76.28 ± 4.48	43.24 ± 2.35	49.00 ± 1.52	29.96 ± 1.14
<i>Solanum nigrum</i> L.	57	331	79.54 ± 1.17	84.92 ± 1.21	88.10 ± 0.35	53.44 ± 0.61
<i>Thlaspi arvense</i> L.	273	1208	88.00 ± 1.42	52.04 ± 0.97	64.12 ± 1.10	41.56 ± 0.36
<i>Triticum aestivum</i> L.	58	1772	73.74 ± 1.24	66.12 ± 1.45	71.86 ± 1.11	31.86 ± 1.11
<i>Veronica persica</i> Poir.	108	322	83.32 ± 1.87	67.36 ± 1.94	71.78 ± 1.23	39.40 ± 0.78
<i>Zea mays</i> L.	65	1327	83.58 ± 1.68	77.80 ± 0.83	84.64 ± 0.82	51.66 ± 0.59

Table 20 Performance of YOLOv10s for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	78.20 $\pm$ 1.23	73.54 $\pm$ 1.17	80.20 $\pm$ 0.70	46.14 $\pm$ 0.66
<i>Elymus repens</i> (L.) Gould	53	309	74.94 $\pm$ 2.04	72.72 $\pm$ 2.32	76.82 $\pm$ 0.76	35.82 $\pm$ 0.59
<i>Alopecurus myosuroides</i> Huds.	77	635	92.04 $\pm$ 0.67	81.74 $\pm$ 1.01	88.20 $\pm$ 1.01	49.34 $\pm$ 1.24
<i>Amaranthus retroflexus</i> L.	94	418	85.94 $\pm$ 1.42	57.78 $\pm$ 0.65	68.48 $\pm$ 1.58	51.70 $\pm$ 0.79
<i>Avena fatua</i> L.	77	1131	78.62 $\pm$ 2.35	64.88 $\pm$ 0.90	72.84 $\pm$ 0.68	39.34 $\pm$ 0.81
<i>Chenopodium album</i> L.	101	329	79.48 $\pm$ 1.71	53.58 $\pm$ 2.02	64.58 $\pm$ 1.11	39.90 $\pm$ 0.57
<i>Geranium</i> spp.	53	1347	79.94 $\pm$ 0.78	57.48 $\pm$ 1.06	66.60 $\pm$ 1.37	31.92 $\pm$ 0.81
<i>Helianthus annuus</i> L.	56	1873	78.56 $\pm$ 1.20	73.08 $\pm$ 1.83	81.04 $\pm$ 1.82	59.08 $\pm$ 1.42
<i>Lamium purpureum</i> L.	214	1069	88.76 $\pm$ 1.46	56.88 $\pm$ 0.72	66.92 $\pm$ 0.69	39.20 $\pm$ 0.34
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	73.06 $\pm$ 6.03	58.40 $\pm$ 1.69	61.36 $\pm$ 1.03	43.90 $\pm$ 0.78
<i>Setaria</i> spp.	134	275	76.10 $\pm$ 3.06	44.88 $\pm$ 1.18	49.28 $\pm$ 0.68	29.88 $\pm$ 0.60
<i>Solanum nigrum</i> L.	57	331	80.30 $\pm$ 4.09	84.36 $\pm$ 2.34	87.34 $\pm$ 0.86	53.44 $\pm$ 0.61
<i>Thlaspi arvense</i> L.	273	1208	84.54 $\pm$ 2.17	50.90 $\pm$ 0.96	62.00 $\pm$ 0.81	40.06 $\pm$ 0.57
<i>Triticum aestivum</i> L.	58	1772	75.18 $\pm$ 1.23	63.88 $\pm$ 1.16	70.68 $\pm$ 0.77	31.22 $\pm$ 0.41
<i>Veronica persica</i> Poir.	108	322	81.40 $\pm$ 2.00	67.72 $\pm$ 1.36	71.32 $\pm$ 0.98	39.84 $\pm$ 0.57
<i>Zea mays</i> L.	65	1327	84.98 $\pm$ 1.45	76.14 $\pm$ 1.14	85.12 $\pm$ 0.73	51.54 $\pm$ 0.30

Table 21 Performance of YOLOv10n for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	78.00 $\pm$ 0.77	70.78 $\pm$ 0.93	77.88 $\pm$ 0.83	43.70 $\pm$ 0.52
<i>Elymus repens</i> (L.) Gould	53	309	76.80 $\pm$ 1.56	71.90 $\pm$ 2.32	77.02 $\pm$ 1.42	36.82 $\pm$ 1.97
<i>Alopecurus myosuroides</i> Huds.	77	635	91.50 $\pm$ 0.66	79.76 $\pm$ 0.80	87.12 $\pm$ 0.68	48.46 $\pm$ 1.32
<i>Amaranthus retroflexus</i> L.	94	418	87.82 $\pm$ 0.90	56.98 $\pm$ 0.77	67.82 $\pm$ 0.54	50.20 $\pm$ 0.35
<i>Avena fatua</i> L.	77	1131	79.62 $\pm$ 0.65	63.82 $\pm$ 0.88	71.60 $\pm$ 0.69	38.22 $\pm$ 0.46
<i>Chenopodium album</i> L.	101	329	78.88 $\pm$ 1.36	52.46 $\pm$ 2.09	62.36 $\pm$ 0.80	37.40 $\pm$ 1.08
<i>Geranium</i> spp.	53	1347	81.06 $\pm$ 1.35	54.90 $\pm$ 0.98	65.68 $\pm$ 1.72	31.86 $\pm$ 0.88
<i>Helianthus annuus</i> L.	56	1873	77.62 $\pm$ 1.08	71.58 $\pm$ 0.24	79.08 $\pm$ 0.74	57.38 $\pm$ 0.58
<i>Lamium purpureum</i> L.	214	1069	87.20 $\pm$ 0.60	56.26 $\pm$ 0.62	64.96 $\pm$ 0.19	38.92 $\pm$ 0.35
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	69.82 $\pm$ 3.63	59.44 $\pm$ 1.52	61.24 $\pm$ 1.75	44.86 $\pm$ 1.67
<i>Setaria</i> spp.	134	275	71.84 $\pm$ 1.70	45.24 $\pm$ 1.64	48.60 $\pm$ 0.79	29.18 $\pm$ 0.58
<i>Solanum nigrum</i> L.	57	331	80.14 $\pm$ 1.43	84.36 $\pm$ 1.40	86.34 $\pm$ 0.55	53.40 $\pm$ 0.66
<i>Thlaspi arvense</i> L.	273	1208	84.74 $\pm$ 0.84	48.98 $\pm$ 0.70	60.10 $\pm$ 0.55	38.56 $\pm$ 0.38
<i>Triticum aestivum</i> L.	58	1772	75.62 $\pm$ 0.68	62.24 $\pm$ 1.56	70.20 $\pm$ 0.27	30.60 $\pm$ 0.43
<i>Veronica persica</i> Poir.	108	322	77.92 $\pm$ 1.26	67.12 $\pm$ 1.25	70.16 $\pm$ 0.83	39.64 $\pm$ 0.88
<i>Zea mays</i> L.	65	1327	82.92 $\pm$ 1.14	74.22 $\pm$ 0.89	83.08 $\pm$ 0.66	50.18 $\pm$ 0.46

10.2.5 Performance of RT-DETR

Table 22 Performance of RT-DETR-x for all species, across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.44 $\pm$ 2.00	77.78 $\pm$ 1.60	77.94 $\pm$ 1.86	45.62 $\pm$ 1.24
<i>Elymus repens</i> (L.) Gould	53	309	76.14 $\pm$ 3.79	72.40 $\pm$ 1.37	75.74 $\pm$ 1.60	34.66 $\pm$ 1.16
<i>Alopecurus myosuroides</i> Huds.	77	635	90.24 $\pm$ 1.40	81.30 $\pm$ 1.49	86.18 $\pm$ 1.44	48.42 $\pm$ 1.70
<i>Amaranthus retroflexus</i> L.	94	418	85.24 $\pm$ 2.34	58.62 $\pm$ 0.75	68.46 $\pm$ 0.99	50.04 $\pm$ 0.53
<i>Avena fatua</i> L.	77	1131	77.98 $\pm$ 1.56	66.04 $\pm$ 1.42	71.12 $\pm$ 1.63	39.60 $\pm$ 1.08
<i>Chenopodium album</i> L.	101	329	82.00 $\pm$ 2.47	57.92 $\pm$ 2.88	67.00 $\pm$ 0.31	40.70 $\pm$ 0.75
<i>Geranium</i> spp.	53	1347	80.18 $\pm$ 1.63	61.06 $\pm$ 1.24	66.96 $\pm$ 2.22	30.60 $\pm$ 1.12
<i>Helianthus annuus</i> L.	56	1873	80.66 $\pm$ 1.40	74.86 $\pm$ 1.18	79.30 $\pm$ 1.90	57.04 $\pm$ 1.46
<i>Lamium purpureum</i> L.	214	1069	90.56 $\pm$ 0.98	58.46 $\pm$ 2.01	65.02 $\pm$ 1.04	37.18 $\pm$ 1.16
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	75.56 $\pm$ 1.35	60.92 $\pm$ 1.53	62.32 $\pm$ 1.13	48.00 $\pm$ 1.27
<i>Setaria</i> spp.	134	275	80.16 $\pm$ 2.51	44.80 $\pm$ 2.53	48.00 $\pm$ 2.30	28.30 $\pm$ 1.18
<i>Solanum nigrum</i> L.	57	331	79.92 $\pm$ 3.26	84.54 $\pm$ 0.75	86.68 $\pm$ 1.36	52.96 $\pm$ 1.93
<i>Thlaspi arvense</i> L.	273	1208	87.74 $\pm$ 1.84	49.32 $\pm$ 1.75	59.34 $\pm$ 1.63	37.84 $\pm$ 0.88
<i>Triticum aestivum</i> L.	58	1772	76.28 $\pm$ 2.30	68.20 $\pm$ 0.98	69.24 $\pm$ 1.46	30.50 $\pm$ 0.99
<i>Veronica persica</i> Poir.	108	322	88.72 $\pm$ 1.68	68.14 $\pm$ 1.88	72.32 $\pm$ 0.49	39.40 $\pm$ 0.87
<i>Zea mays</i> L.	65	1327	85.08 $\pm$ 0.91	77.26 $\pm$ 1.24	81.54 $\pm$ 1.26	49.30 $\pm$ 0.64

Table 23 Performance of RT-DETR-l for all species, across images and instances, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
<i>Abutilon theophrasti</i> Medik.	48	1166	76.98 $\pm$ 0.77	76.72 $\pm$ 0.71	78.08 $\pm$ 0.88	45.56 $\pm$ 0.98
<i>Elymus repens</i> (L.) Go	53	309	77.64 $\pm$ 3.17	69.90 $\pm$ 2.54	75.06 $\pm$ 2.14	34.18 $\pm$ 1.57
<i>Alopecurus myosuroides</i> Huds.	77	635	91.22 $\pm$ 0.90	81.88 $\pm$ 0.50	86.38 $\pm$ 0.59	49.16 $\pm$ 0.82
<i>Amaranthus retroflexus</i> L.	94	418	88.00 $\pm$ 1.38	57.84 $\pm$ 1.80	68.92 $\pm$ 1.51	49.60 $\pm$ 0.97
<i>Avena fatua</i> L.	77	1131	78.66 $\pm$ 1.59	66.90 $\pm$ 1.93	72.34 $\pm$ 1.11	39.88 $\pm$ 0.70
<i>Chenopodium album</i> L.	101	329	82.66 $\pm$ 3.41	56.12 $\pm$ 2.37	67.18 $\pm$ 1.85	40.54 $\pm$ 0.90
<i>Geranium</i> spp.	53	1347	81.12 $\pm$ 1.25	59.42 $\pm$ 1.57	66.46 $\pm$ 1.31	30.36 $\pm$ 0.81
<i>Helianthus annuus</i> L.	56	1873	82.20 $\pm$ 1.51	74.96 $\pm$ 1.22	79.18 $\pm$ 1.91	57.06 $\pm$ 1.26
<i>Lamium purpureum</i> L.	214	1069	89.76 $\pm$ 1.11	58.76 $\pm$ 1.53	64.60 $\pm$ 1.09	37.16 $\pm$ 0.90
<i>Fallopia convolvulus</i> (L.) Á. Löve	78	115	73.90 $\pm$ 7.05	62.18 $\pm$ 0.88	63.02 $\pm$ 0.93	48.22 $\pm$ 1.34
<i>Setaria</i> spp.	134	275	79.30 $\pm$ 5.37	43.90 $\pm$ 0.86	47.20 $\pm$ 0.29	28.30 $\pm$ 1.10
<i>Solanum nigrum</i> L.	57	331	78.14 $\pm$ 3.86	83.82 $\pm$ 2.28	86.16 $\pm$ 0.75	52.42 $\pm$ 0.97
<i>Thlaspi arvense</i> L.	273	1208	88.86 $\pm$ 1.26	49.72 $\pm$ 1.18	59.32 $\pm$ 0.61	38.14 $\pm$ 0.57
<i>Triticum aestivum</i> L.	58	1772	76.94 $\pm$ 1.45	68.84 $\pm$ 0.90	69.84 $\pm$ 2.13	30.28 $\pm$ 1.03
<i>Veronica persica</i> Poir.	108	322	88.88 $\pm$ 2.31	68.10 $\pm$ 1.67	71.62 $\pm$ 0.83	39.80 $\pm$ 0.61
<i>Zea mays</i> L.	65	1327	84.54 $\pm$ 1.50	77.38 $\pm$ 0.71	81.98 $\pm$ 0.44	49.62 $\pm$ 0.59

10.2.6 Dataset 2

10.2.7 Performance of YOLOv8

Table 24 Performance of YOLOv8x for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.54 $\pm$ 0.48	66.28 $\pm$ 0.46	76.64 $\pm$ 0.75	44.18 $\pm$ 0.65
Monocot	312	2350	81.42 $\pm$ 0.52	70.78 $\pm$ 0.52	77.04 $\pm$ 0.81	42.30 $\pm$ 0.51
<i>Helianthus annuus</i> L. (sunflower)	56	1873	80.18 $\pm$ 1.25	76.62 $\pm$ 1.13	83.36 $\pm$ 0.95	60.72 $\pm$ 0.94
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	74.18 $\pm$ 1.80	68.60 $\pm$ 1.22	72.30 $\pm$ 1.65	32.02 $\pm$ 1.41
<i>Zea mays</i> L. (maize)	65	1327	82.26 $\pm$ 0.86	76.90 $\pm$ 0.73	84.32 $\pm$ 0.58	51.44 $\pm$ 0.64

Table 25 Performance of YOLOv8l for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	85.28 ± 0.70	65.54 ± 0.91	76.90 ± 0.67	44.62 ± 0.32
Monocot	312	2350	80.94 ± 0.96	70.32 ± 1.28	77.04 ± 1.02	42.22 ± 0.85
<i>Helianthus annuus</i> L. (sunflower)	56	1873	79.74 ± 0.70	76.06 ± 1.29	83.52 ± 1.21	60.96 ± 1.04
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	73.80 ± 1.55	67.28 ± 0.59	71.64 ± 1.09	32.02 ± 0.40
<i>Zea mays</i> L. (maize)	65	1327	82.90 ± 1.16	76.48 ± 1.22	84.36 ± 0.76	51.44 ± 1.14

Table 26 Performance of YOLOv8m for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.74 ± 0.63	65.86 ± 1.34	77.00 ± 0.77	44.30 ± 0.42
Monocot	312	2350	79.98 ± 0.66	69.52 ± 0.98	76.36 ± 0.83	41.22 ± 0.68
<i>Helianthus annuus</i> L. (sunflower)	56	1873	78.38 ± 1.03	76.28 ± 1.15	84.28 ± 0.92	61.62 ± 0.89
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	74.24 ± 1.05	69.02 ± 0.93	73.04 ± 1.27	32.26 ± 1.31
<i>Zea mays</i> L. (maize)	65	1327	82.78 ± 1.17	77.06 ± 1.33	83.90 ± 0.89	51.34 ± 1.19

Table 27 Performance of YOLOv8s for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	85.28 $\pm$ 0.93	66.18 $\pm$ 1.55	77.42 $\pm$ 0.65	44.28 $\pm$ 0.41
Monocot	312	2350	81.18 $\pm$ 1.85	69.72 $\pm$ 1.29	77.12 $\pm$ 0.39	41.68 $\pm$ 0.47
<i>Helianthus annuus</i> L. (sunflower)	56	1873	78.82 $\pm$ 2.14	76.24 $\pm$ 0.76	84.00 $\pm$ 0.80	60.88 $\pm$ 0.65
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	74.40 $\pm$ 1.43	68.32 $\pm$ 0.99	72.80 $\pm$ 0.56	32.32 $\pm$ 0.47
<i>Zea mays</i> L. (maize)	65	1327	84.26 $\pm$ 1.06	78.10 $\pm$ 0.97	85.40 $\pm$ 0.41	51.90 $\pm$ 0.48

Table 28 Performance of YOLOv8n for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.52 $\pm$ 0.53	66.28 $\pm$ 0.76	76.76 $\pm$ 0.49	44.32 $\pm$ 0.30
Monocot	312	2350	80.74 $\pm$ 1.08	70.70 $\pm$ 0.77	77.32 $\pm$ 0.41	41.30 $\pm$ 0.17
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.04 $\pm$ 1.62	76.36 $\pm$ 0.60	83.68 $\pm$ 0.69	60.62 $\pm$ 0.74
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	73.30 $\pm$ 1.56	66.78 $\pm$ 0.95	71.98 $\pm$ 1.82	31.58 $\pm$ 0.89
<i>Zea mays</i> L. (maize)	65	1327	82.52 $\pm$ 0.92	77.80 $\pm$ 0.82	84.82 $\pm$ 0.83	51.84 $\pm$ 0.63

10.2.8 Performance of YOLOv9

Table 29 Performance of YOLOv9e for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.66 ± 67.44	67.44 ± 0.93	78.56 ± 0.46	45.82 ± 0.26
Monocot	312	2350	80.94 ± 70.20	70.20 ± 0.98	78.10 ± 0.60	43.92 ± 0.27
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.68 ± 76.78	76.78 ± 0.72	84.30 ± 1.09	61.52 ± 0.84
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	73.08 ± 68.34	68.34 ± 1.74	73.18 ± 1.44	32.78 ± 1.02
<i>Zea mays</i> L. (maize)	65	1327	82.56 ± 77.88	77.88 ± 1.38	84.60 ± 0.68	52.22 ± 1.02

Table 30 Performance of YOLOv9c for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances per species, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.76 $\pm$ 0.59	66.40 $\pm$ 0.88	77.32 $\pm$ 0.53	44.66 $\pm$ 0.42
Monocot	312	2350	80.64 $\pm$ 1.11	70.18 $\pm$ 0.26	77.04 $\pm$ 0.64	42.32 $\pm$ 0.43
<i>Helianthus annuus</i> L. (sunflower)	56	1873	78.72 $\pm$ 1.93	76.04 $\pm$ 1.22	84.26 $\pm$ 1.21	61.40 $\pm$ 0.99
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	73.20 $\pm$ 2.03	69.00 $\pm$ 1.47	72.62 $\pm$ 1.96	32.58 $\pm$ 1.04
<i>Zea mays</i> L. (maize)	65	1327	82.98 $\pm$ 1.79	78.22 $\pm$ 0.98	84.50 $\pm$ 0.86	51.58 $\pm$ 0.83

Table 31 Performance of YOLOv9m for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.70 $\pm$ 0.43	66.68 $\pm$ 0.60	77.68 $\pm$ 0.74	45.08 $\pm$ 0.29
Monocot	312	2350	81.30 $\pm$ 1.68	70.04 $\pm$ 0.70	77.86 $\pm$ 1.14	42.56 $\pm$ 0.64
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.26 $\pm$ 1.66	76.06 $\pm$ 1.54	83.78 $\pm$ 1.11	61.16 $\pm$ 1.16
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	74.42 $\pm$ 1.12	68.08 $\pm$ 0.92	73.12 $\pm$ 1.47	32.86 $\pm$ 0.76
<i>Zea mays</i> L. (maize)	65	1327	81.92 $\pm$ 1.43	77.76 $\pm$ 0.46	84.52 $\pm$ 0.37	51.36 $\pm$ 0.61

Table 32 Performance of YOLOv9s for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.88 $\pm$ 0.62	67.36 $\pm$ 0.55	77.76 $\pm$ 0.30	45.28 $\pm$ 0.30
Monocot	312	2350	82.36 $\pm$ 0.84	71.14 $\pm$ 0.82	78.70 $\pm$ 0.33	43.54 $\pm$ 0.33
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.92 $\pm$ 1.63	75.66 $\pm$ 1.29	83.66 $\pm$ 1.59	61.22 $\pm$ 1.24
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	74.64 $\pm$ 0.86	68.84 $\pm$ 0.69	74.04 $\pm$ 0.27	33.00 $\pm$ 0.41
<i>Zea mays</i> L. (maize)	65	1327	83.30 $\pm$ 0.76	78.82 $\pm$ 0.58	85.10 $\pm$ 0.32	52.02 $\pm$ 0.31

Table 33 Performance of YOLOv9t for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	85.66 ± 0.68	65.40 ± 1.23	76.32 ± 0.50	44.76 ± 0.27
Monocot	312	2350	82.72 ± 0.92	71.04 ± 0.75	78.38 ± 0.40	43.24 ± 0.26
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.20 ± 1.88	75.16 ± 0.42	83.58 ± 0.72	61.00 ± 0.71
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	74.68 ± 0.90	68.36 ± 0.55	73.84 ± 0.83	33.20 ± 0.41
<i>Zea mays</i> L. (maize)	65	1327	83.94 ± 0.72	78.18 ± 0.98	85.64 ± 0.54	52.34 ± 0.32

10.2.9 Performance of YOLOv10

Table 34 Performance of YOLOv10x for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.60 $\pm$ 0.91	64.80 $\pm$ 0.99	76.08 $\pm$ 0.83	44.04 $\pm$ 0.56
Monocot	312	2350	81.48 $\pm$ 1.40	69.66 $\pm$ 0.45	76.68 $\pm$ 0.47	41.84 $\pm$ 0.44
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.90 $\pm$ 1.20	74.46 $\pm$ 1.99	80.88 $\pm$ 1.70	59.28 $\pm$ 1.22
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	75.42 $\pm$ 1.50	67.04 $\pm$ 0.72	71.62 $\pm$ 0.77	31.44 $\pm$ 0.53
<i>Zea mays</i> L. (maize)	65	1327	82.88 $\pm$ 0.95	76.06 $\pm$ 1.43	83.78 $\pm$ 0.26	51.54 $\pm$ 0.59

Table 35 Performance of YOLOv10l for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances per species, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	85.10 $\pm$ 0.74	65.60 $\pm$ 1.27	77.68 $\pm$ 0.99	45.24 $\pm$ 0.68
Monocot	312	2350	80.84 $\pm$ 1.53	69.82 $\pm$ 0.79	77.08 $\pm$ 0.55	42.50 $\pm$ 0.44
<i>Helianthus annuus</i> L. (sunflower)	56	1873	79.04 $\pm$ 1.75	74.18 $\pm$ 0.89	82.22 $\pm$ 1.00	60.42 $\pm$ 1.08
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	75.02 $\pm$ 1.12	66.62 $\pm$ 1.05	72.16 $\pm$ 0.29	31.74 $\pm$ 0.30
<i>Zea mays</i> L. (maize)	65	1327	82.72 $\pm$ 1.00	76.78 $\pm$ 0.57	84.38 $\pm$ 0.72	52.04 $\pm$ 0.53

Table 36 Performance of YOLOv10m for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	85.02 $\pm$ 0.99	65.98 $\pm$ 0.99	77.36 $\pm$ 0.59	45.22 $\pm$ 0.42
Monocot	312	2350	80.70 $\pm$ 1.41	69.30 $\pm$ 0.85	76.16 $\pm$ 0.48	41.70 $\pm$ 0.45
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.86 $\pm$ 0.88	74.78 $\pm$ 0.78	82.50 $\pm$ 0.61	60.60 $\pm$ 0.25
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	74.64 $\pm$ 1.25	65.54 $\pm$ 1.31	70.68 $\pm$ 1.13	31.24 $\pm$ 0.66
<i>Zea mays</i> L. (maize)	65	1327	82.86 $\pm$ 1.68	75.34 $\pm$ 2.76	83.52 $\pm$ 1.20	51.50 $\pm$ 0.53

Table 37 Performance of YOLOv10s for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.74 ± 0.94	63.68 ± 0.59	75.16 ± 0.64	43.94 ± 0.34
Monocot	312	2350	81.40 ± 1.50	69.28 ± 0.39	75.82 ± 0.62	41.08 ± 0.43
<i>Helianthus annuus</i> L. (sunflower)	56	1873	77.00 ± 1.40	73.76 ± 0.69	82.10 ± 0.47	60.18 ± 0.28
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	74.62 ± 0.58	65.32 ± 0.92	70.44 ± 0.27	31.06 ± 0.46
<i>Zea mays</i> L. (maize)	65	1327	83.48 ± 0.75	77.04 ± 0.76	84.54 ± 0.59	51.40 ± 0.19

Table 38 Performance of YOLOv10n for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.50 $\pm$ 0.81	63.06 $\pm$ 0.44	74.58 $\pm$ 0.27	43.50 $\pm$ 0.17
Monocot	312	2350	81.82 $\pm$ 0.88	68.78 $\pm$ 0.82	76.14 $\pm$ 0.61	41.24 $\pm$ 0.25
<i>Helianthus annuus</i> L. (sunflower)	56	1873	76.12 $\pm$ 1.68	72.96 $\pm$ 0.82	79.64 $\pm$ 0.80	57.68 $\pm$ 0.59
<i>Triticum aestivum</i> L.(winter wheat)	58	1772	74.90 $\pm$ 1.90	64.58 $\pm$ 0.18	71.20 $\pm$ 1.12	31.32 $\pm$ 0.86
<i>Zea mays</i> L. (maize)	65	1327	82.74 $\pm$ 1.45	76.16 $\pm$ 0.72	84.10 $\pm$ 0.82	50.98 $\pm$ 0.15

10.2.10 Performance of RT-DETR

Table 39 Performance of RT-DETR-x for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances, with Precision, Recall, AP50 and AP50-95, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.22 $\pm$ 0.48	67.46 $\pm$ 0.86	76.60 $\pm$ 1.66	43.42 $\pm$ 0.85
Monocot	312	2350	80.80 $\pm$ 1.34	71.36 $\pm$ 1.05	75.52 $\pm$ 1.12	40.88 $\pm$ 0.54
<i>Helianthus annuus</i> L. (sunflower)	56	1873	79.42 $\pm$ 1.52	75.14 $\pm$ 1.05	78.34 $\pm$ 1.11	56.38 $\pm$ 0.48
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	76.58 $\pm$ 1.98	68.76 $\pm$ 2.00	69.44 $\pm$ 3.31	30.36 $\pm$ 1.84
<i>Zea mays</i> L. (maize)	65	1327	84.74 $\pm$ 1.39	77.88 $\pm$ 1.07	82.08 $\pm$ 0.72	49.76 $\pm$ 0.50

Table 40 Performance of RT-DETR-l for Dicot, Monocot, *Helianthus annuus* (sunflower), *Triticum aestivum* (winter wheat), and *Zea mays* (maize), across images and instances per species, with Precision, Recall, AP50, and AP50-95 provided in percentages, with standard deviations (+/- SD) indicated. Bold values represent the highest values.

Class	Images	Instances	Precision	Recall	AP50	AP50-95
Dicot	590	6305	84.14 $\pm$ 0.95	65.88 $\pm$ 0.50	75.56 $\pm$ 0.64	43.04 $\pm$ 0.05
Monocot	312	2350	81.42 $\pm$ 1.85	70.72 $\pm$ 0.93	75.22 $\pm$ 1.05	40.66 $\pm$ 0.84
<i>Helianthus annuus</i> L. (sunflower)	56	1873	80.94 $\pm$ 0.40	75.02 $\pm$ 0.91	78.52 $\pm$ 0.87	56.56 $\pm$ 0.80
<i>Triticum aestivum</i> L. (winter wheat)	58	1772	75.74 $\pm$ 1.34	68.94 $\pm$ 1.29	68.80 $\pm$ 1.98	29.42 $\pm$ 1.07
<i>Zea mays</i> L. (maize)	65	1327	85.06 $\pm$ 1.36	78.30 $\pm$ 1.21	82.58 $\pm$ 1.03	50.20 $\pm$ 0.50