

The Hidden Costs of Extra Tillage Passes

Is it worth it?



Precision Conservation Management



College of Agricultural,
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UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN



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Topics



Economics of Machinery



Tillage benchmark and PCM

Economics of Machinery and PCM



Machinery Cost Estimates: Summary

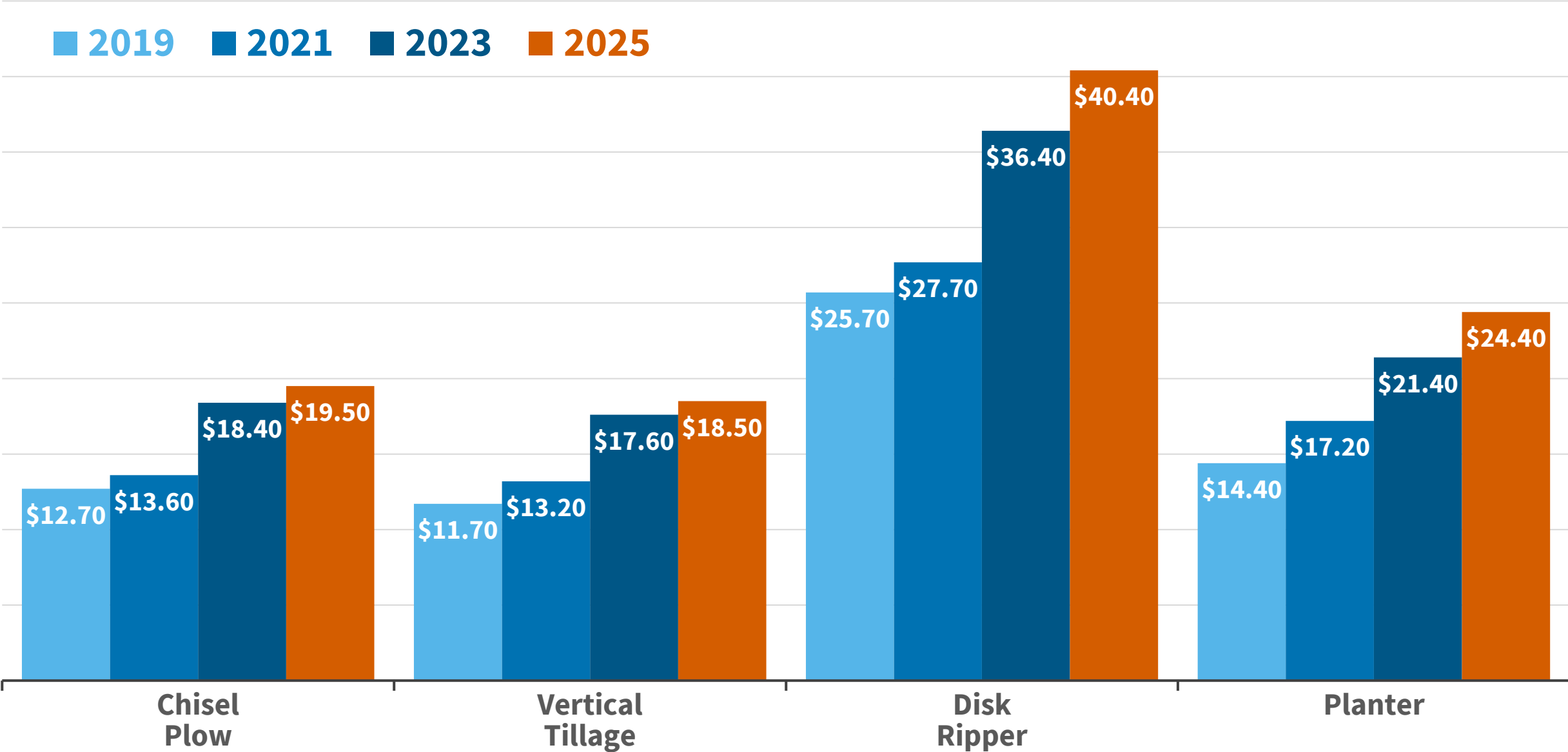


Operation	Total =	Tractor Overhead	Implement Overhead	Fuel & Lube	Labor	Fuel Use
Primary tillage	----- \$ per acre -----					gal
Chisel plow	19.50	9.20	6.90	2.20	1.20	0.7
Coulter chisel plow (disk, chisel, lev	34.70	10.90	15.00	7.20	1.60	2.2
Combination ripper	40.40	13.40	18.10	7.00	1.90	2.1
Vertical tillage, rolling basket	18.50	6.50	9.60	1.50	0.90	0.5
Moldboard plow	54.50	26.30	16.80	6.30	5.10	1.9
Mulch tiller (disk, chisel)	29.60	15.30	7.70	3.60	3.00	1.1
Offset disk	24.60	12.90	6.10	3.10	2.50	0.9
Strip tillage (strips only)	26.10	7.30	14.80	3.00	1.00	0.9
In line ripper	29.90	16.20	6.00	5.40	2.30	1.6

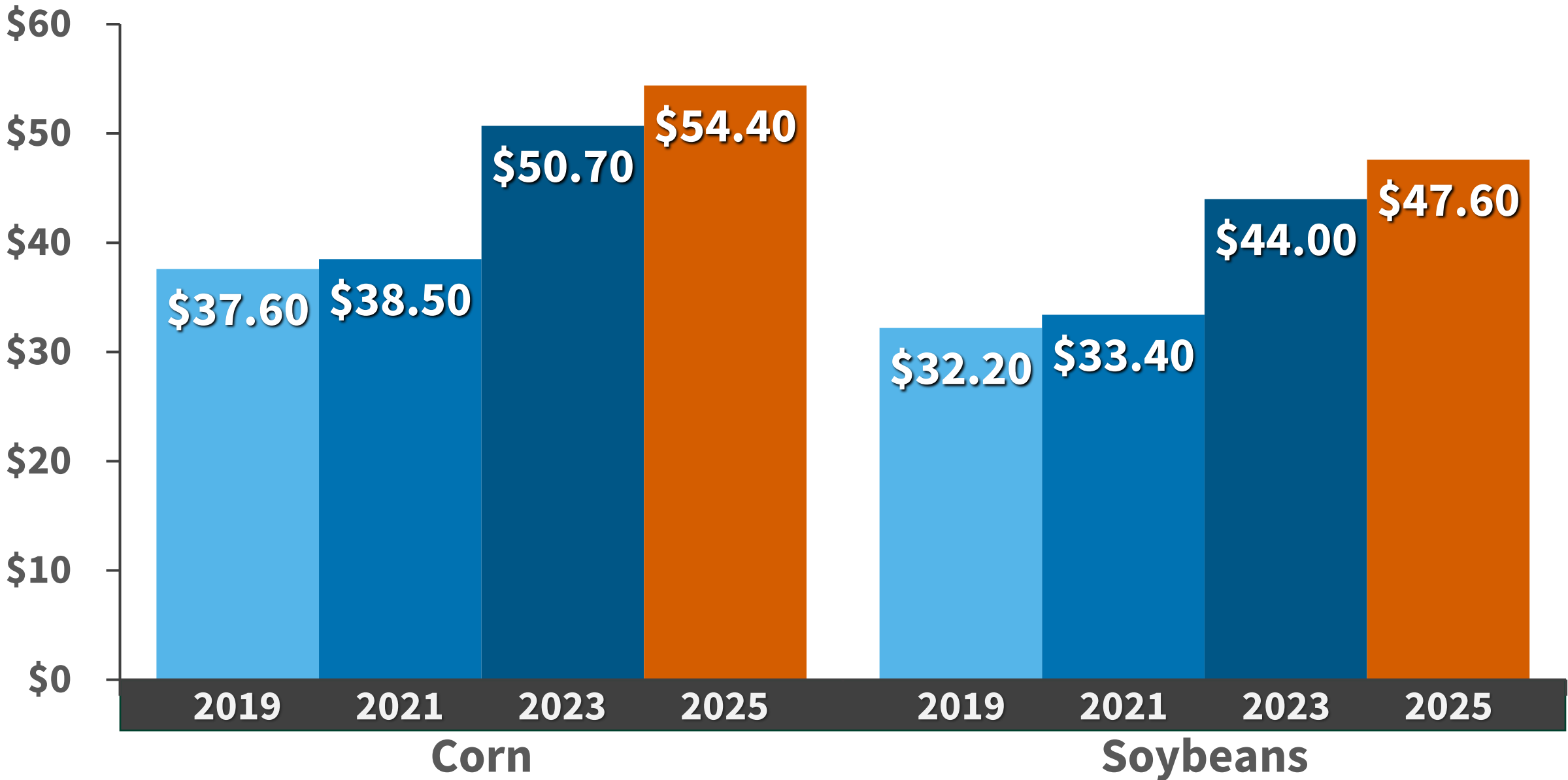
Costs of operation over time (\$ per acre)

	2019	2021	2023	2025
Chisel Plow	\$12.70	\$13.60	\$18.40	\$19.50
Vertical Tillage	\$11.70	\$13.20	\$17.60	\$18.50
Disk Ripper	\$25.70	\$27.70	\$36.40	\$40.40
Planter	\$14.40	\$17.20	\$21.40	\$24.40
Combine				
Corn	\$37.60	\$38.50	\$50.70	\$54.40
Soybeans	\$32.20	\$33.40	\$44.00	\$47.60

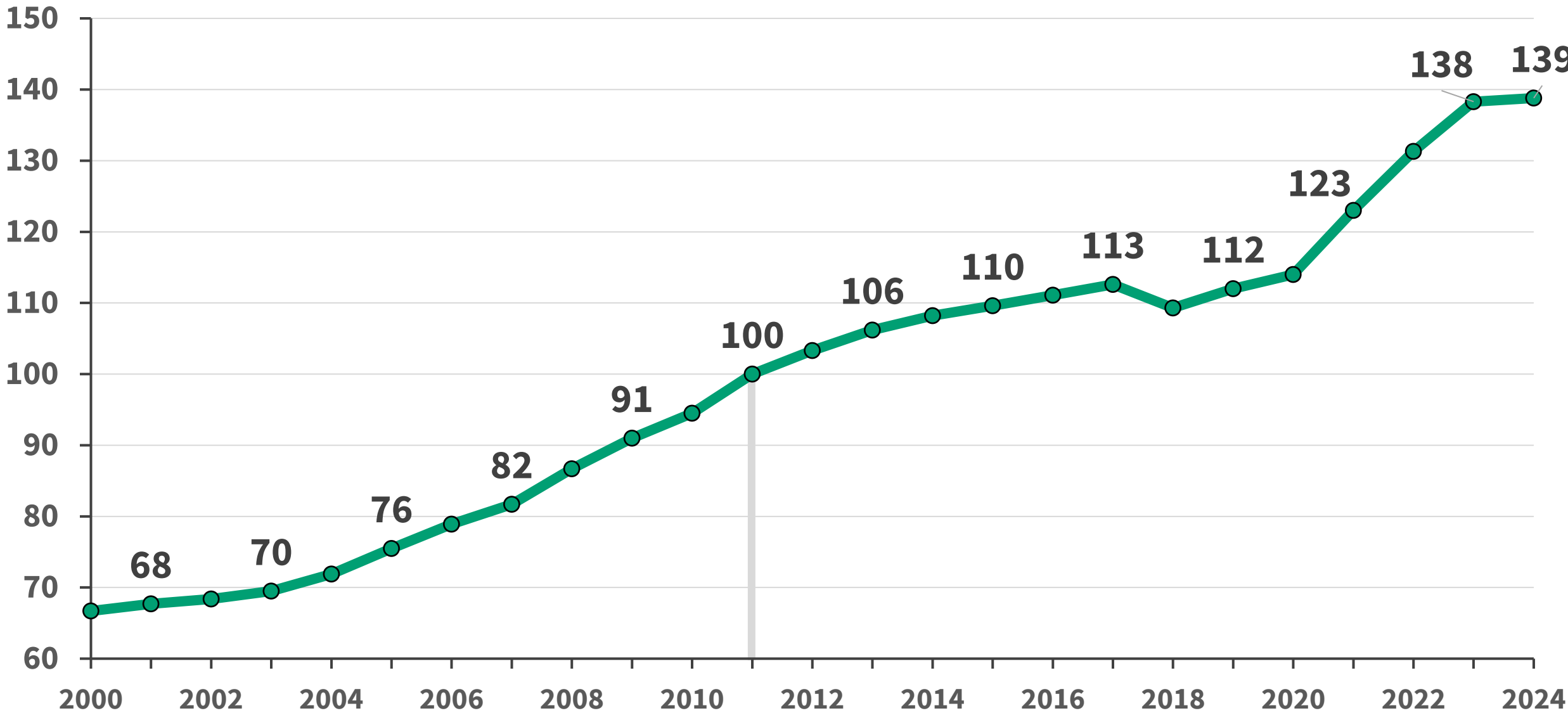
Costs of operation over time (\$ per acre)



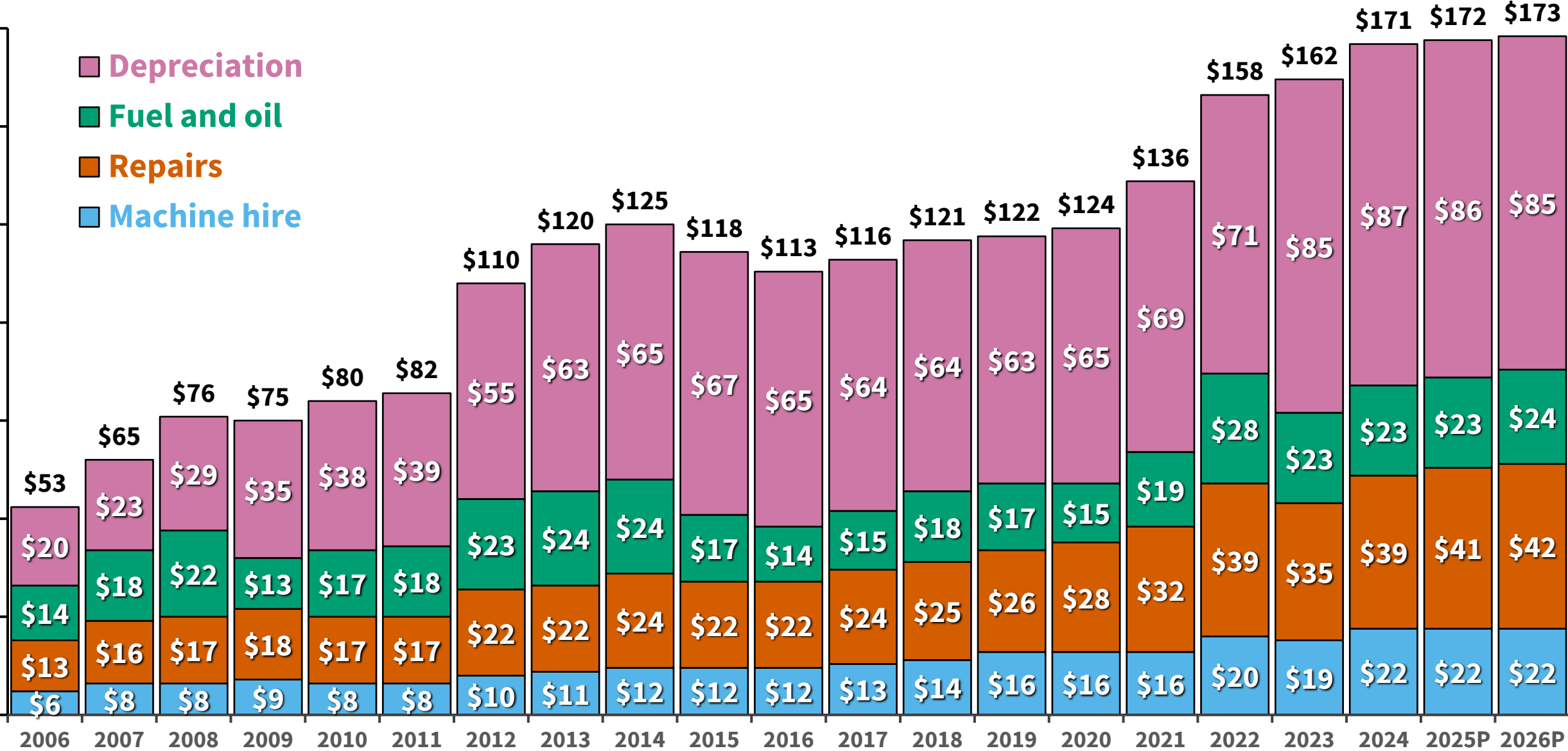
Combine Costs of operation over time (\$ per acre)



Tractor Prices Paid Index



Machinery Related Costs for Corn in \$ per acre



Corn Combine Costs with Different Acres



Summary of machinery economics

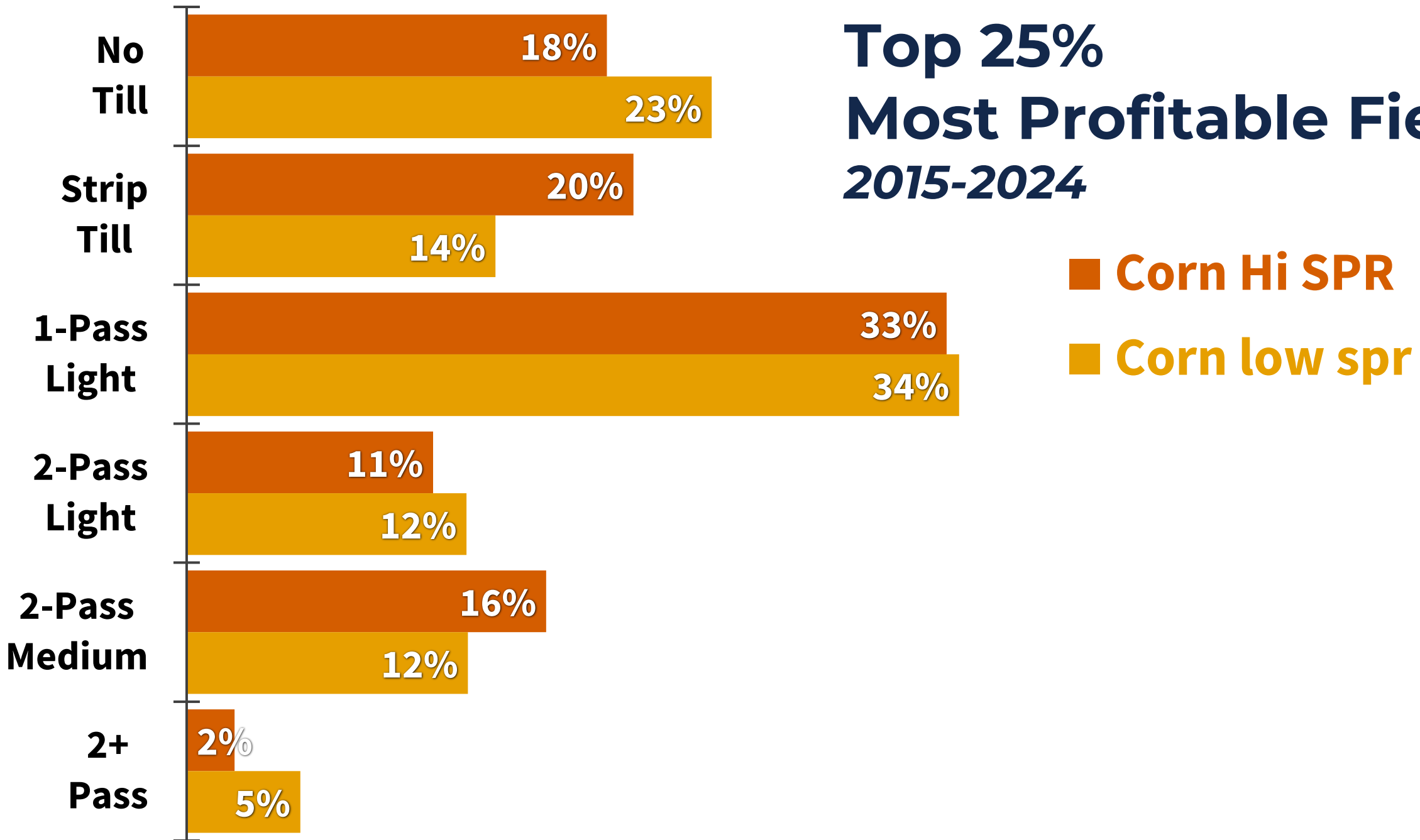
- Size matters and has become more critical
 - Combine ownership with less than 2,000 acres
 - Ownership of two planters is more questionable
- The costs of a tillage pass has increased



Corn



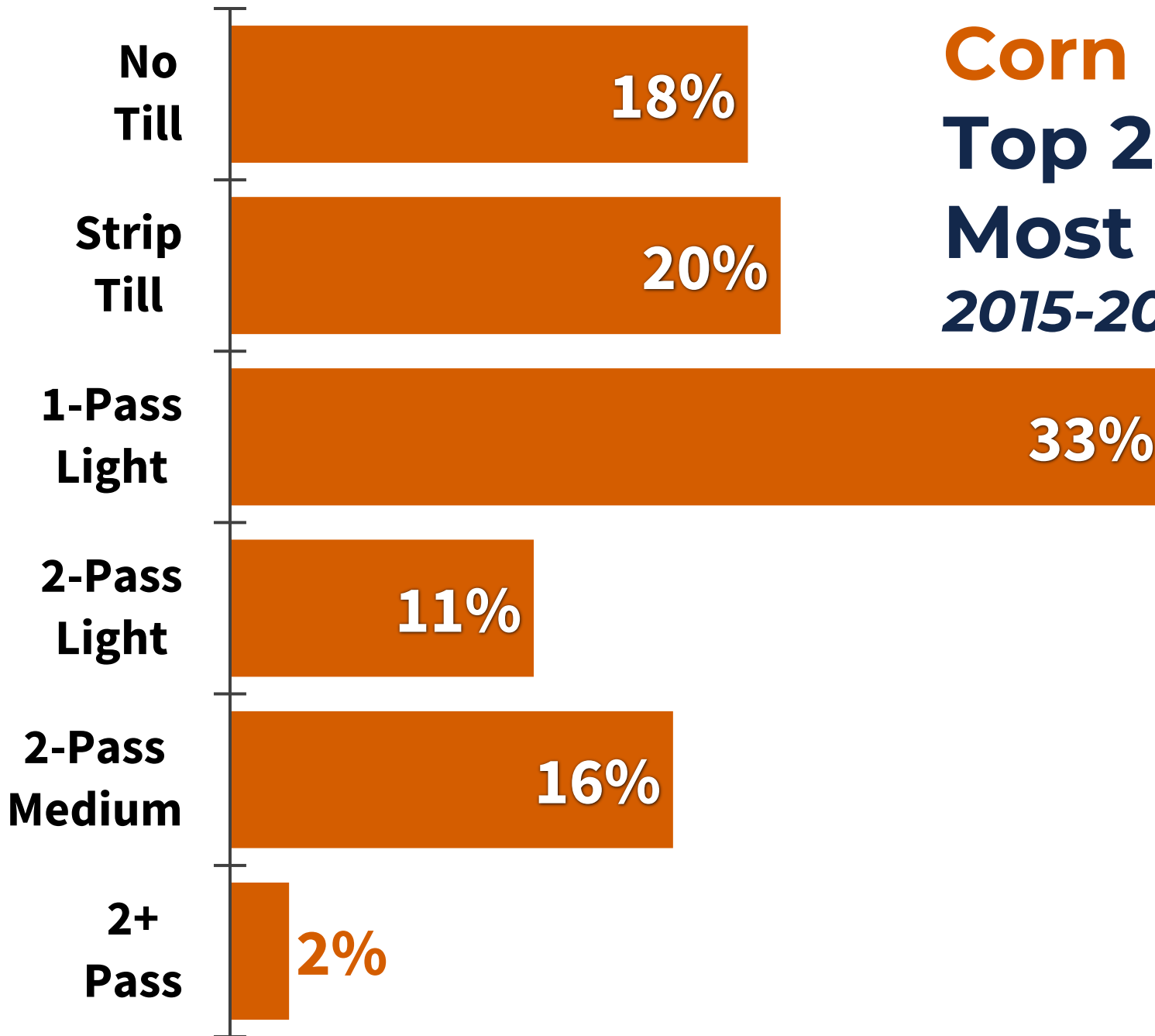
Top 25% Most Profitable Fields 2015-2024



Corn High SPR



Corn High SPR Top 25% Most Profitable Fields 2015-2024

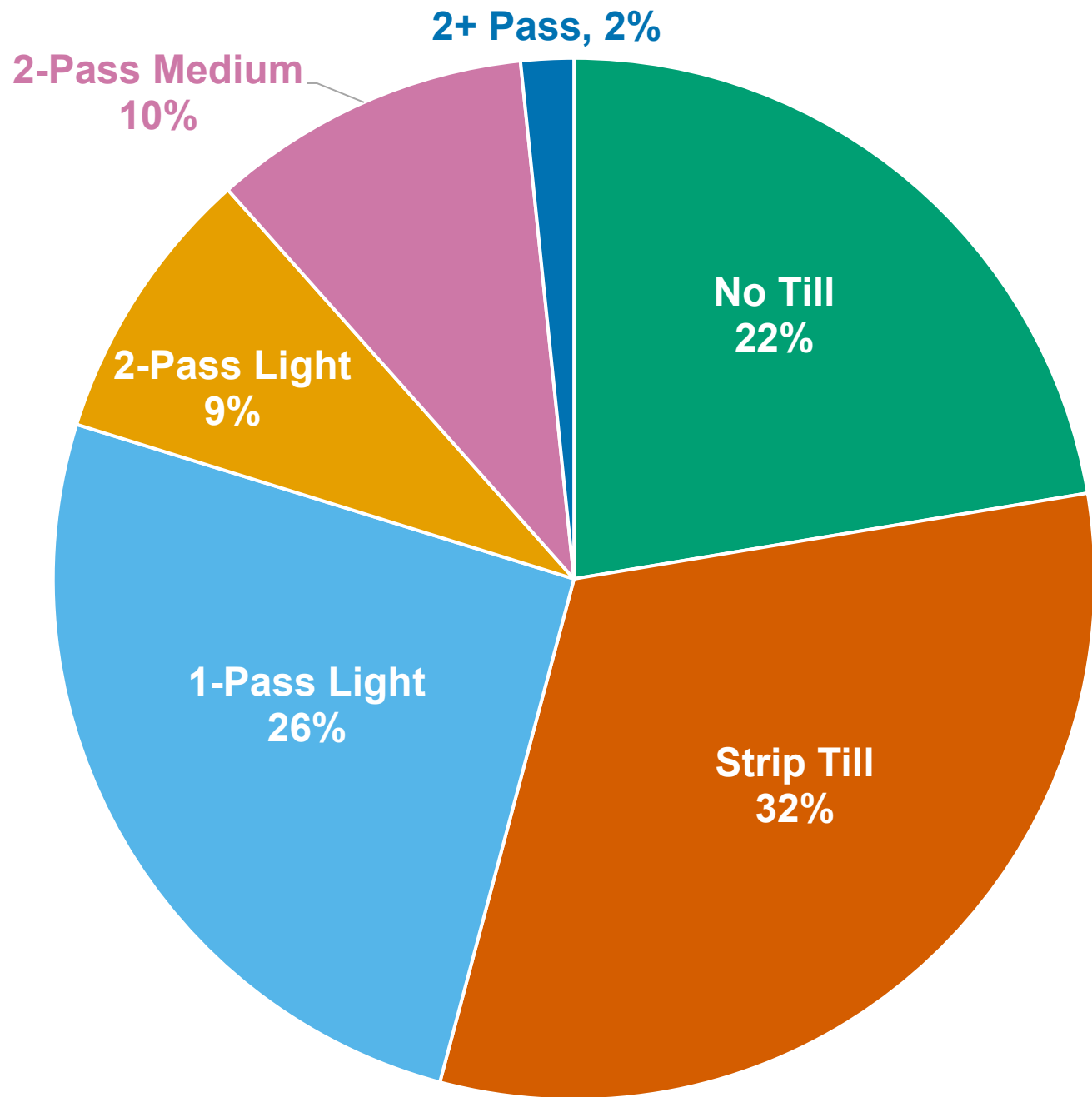




**1,158
High SPR
Corn Fields**

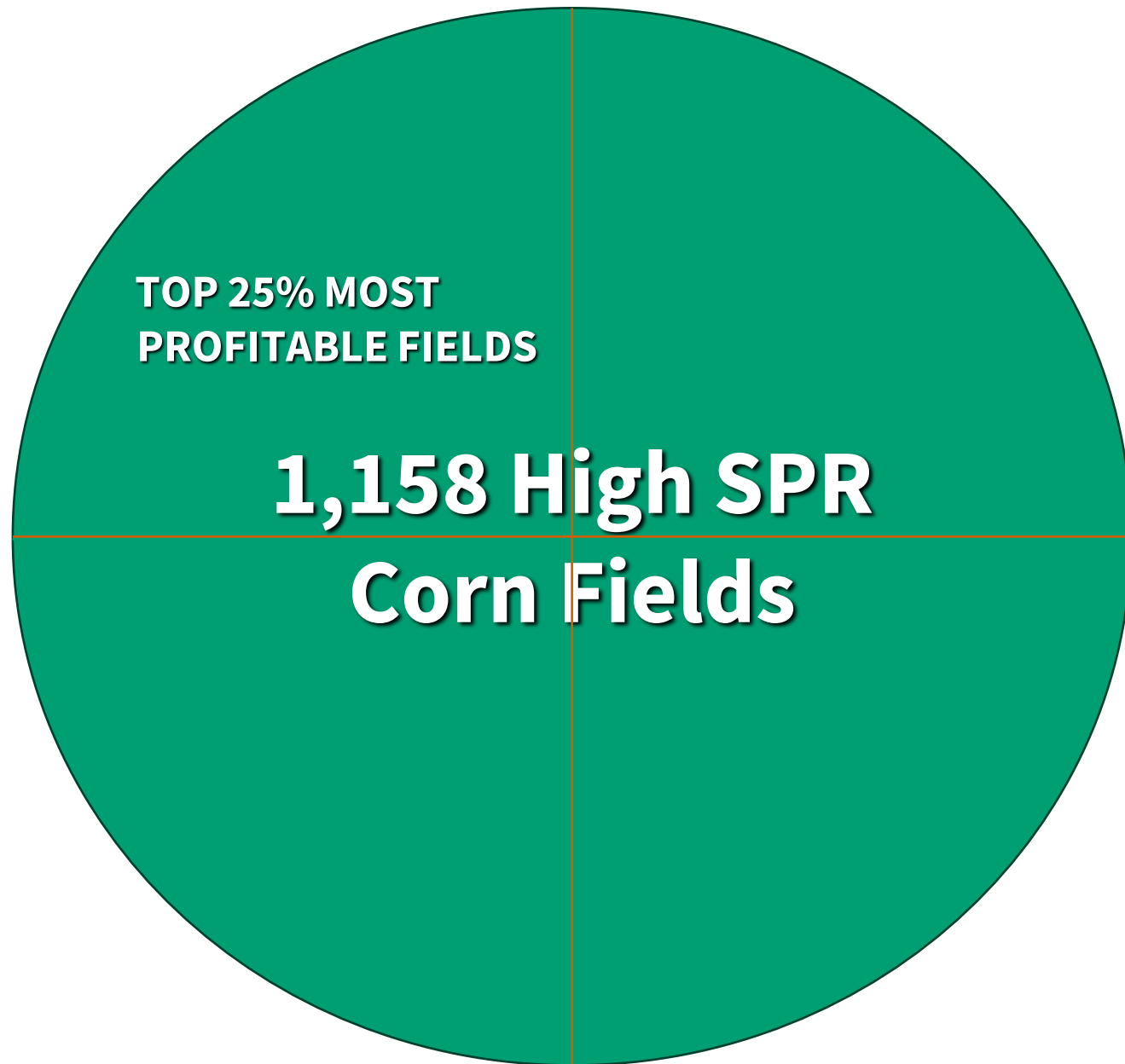
1. TILLAGE PRACTICES
 - I. NO-TILL
 - II. STRIP-TILL
 - III. 1-PASS LIGHT
 - IV. 2-PASS LIGHT
 - V. 2-PASS MEDIUM
 - VI. 2+ TILLAGE PASSES
2. NITROGEN MANAGEMENT PRACTICES
3. COVER CROP PRACTICES

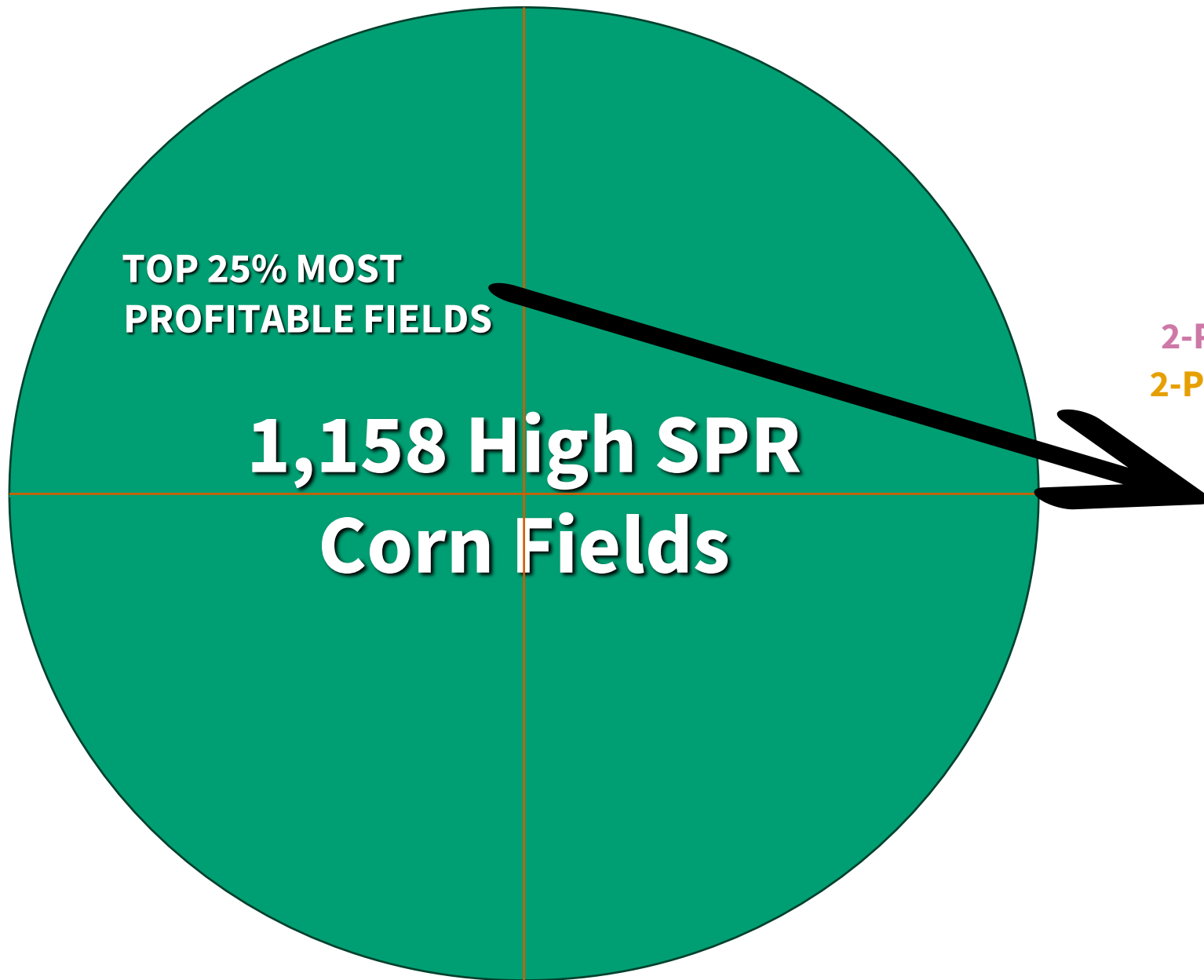
2022



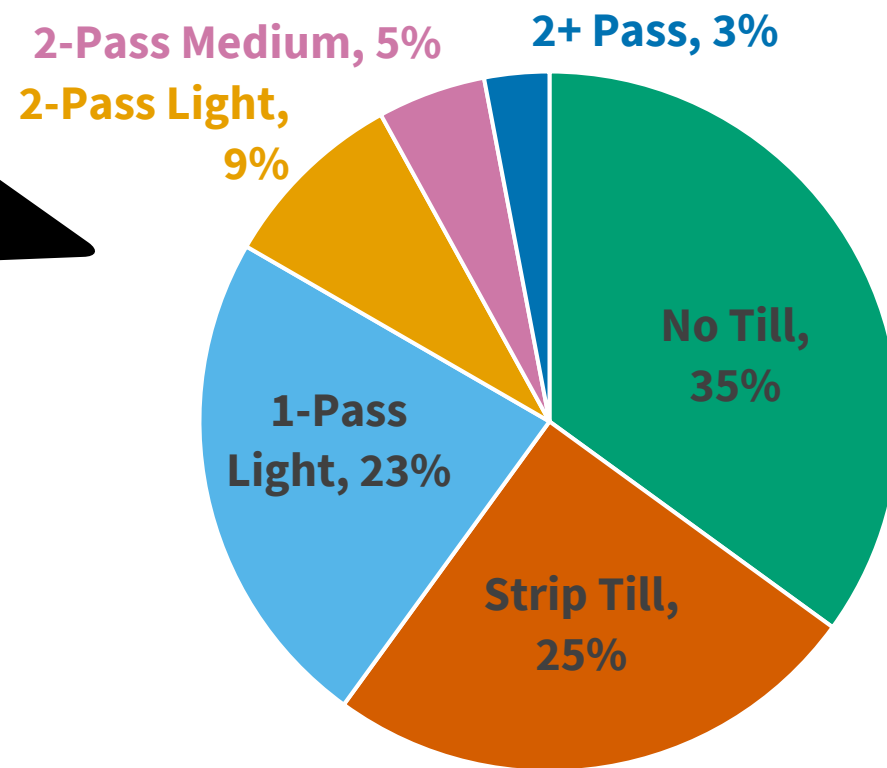
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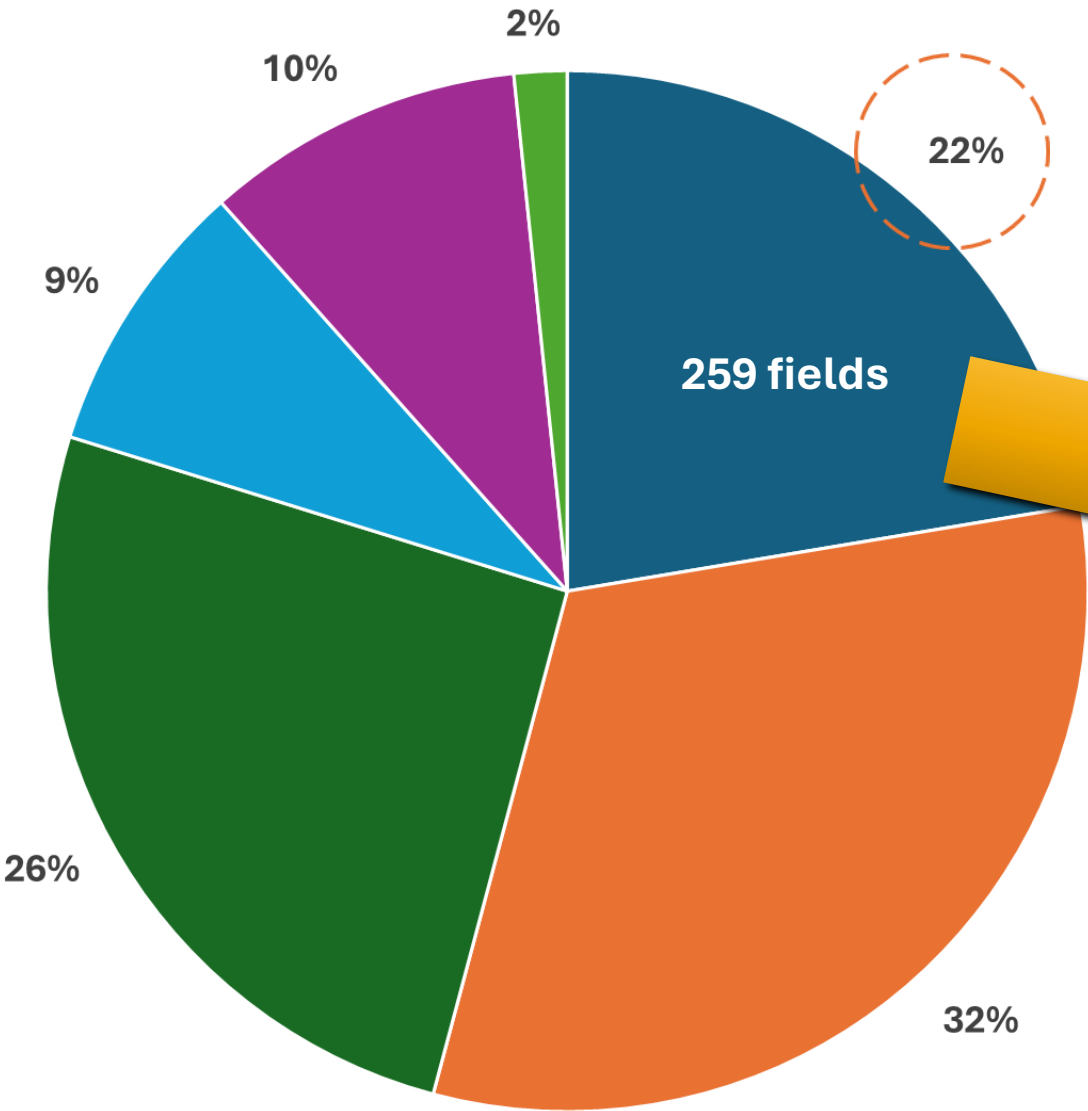




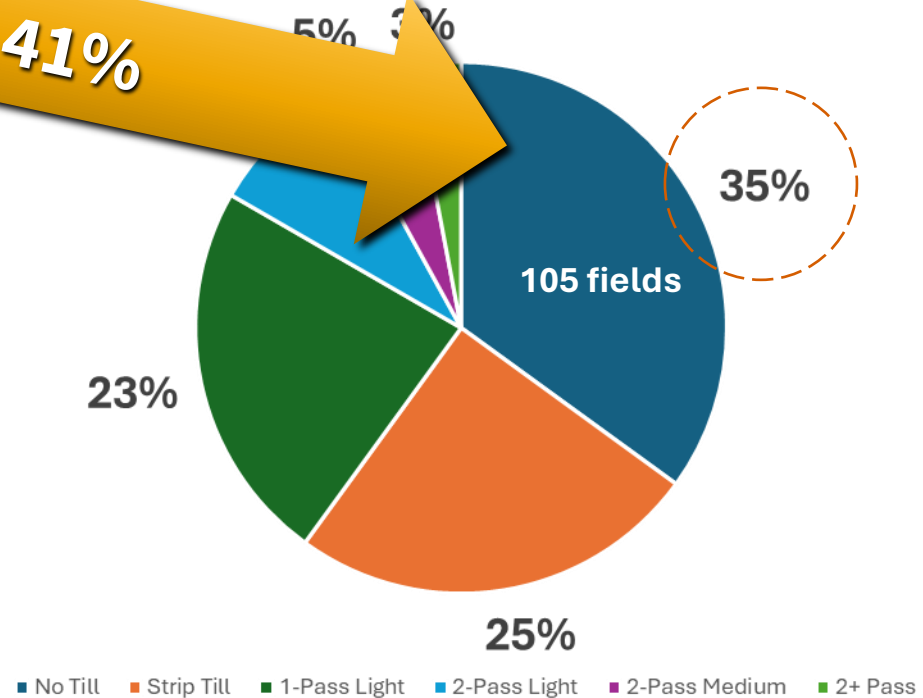
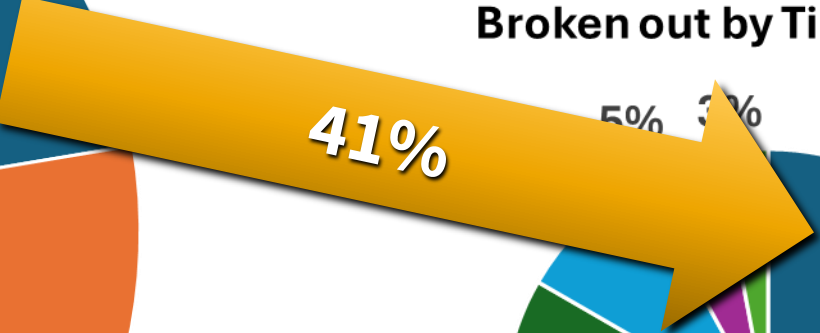
Top 25% Most Profitable Fields Broken out by Tillage Class



ALL PCM HI SPR CORN FIELDS, 2022



Top 25% Most Profitable Fields
Broken out by Tillage Class



	No-till	Strip Till	1-Pass Light	2-Pass Light	2-Pass Moderate	2+ Tillage Passes
Percent of Top 25% Profitable Fields 2015-2024	18%	20%	33%	11%	16%	2%
# Fields	1,534	2,102	2,310	835	986	131
Yield Per Acre	221	224	224	229	229	226
Gross Revenue	\$948	\$958	\$956	\$978	\$980	\$971
Total Non-land Costs	\$601	\$636	\$604	\$630	\$640	\$654
Total Direct Costs*	\$447	\$467	\$442	\$455	\$463	\$461
Total Power Costs	\$113	\$128	\$121	\$134	\$136	\$153
Field Work	\$0	\$22	\$12	\$26	\$30	\$43
Other Power Costs**	\$113	\$106	\$109	\$108	\$106	\$110
Overhead Costs	\$41	\$41	\$41	\$41	\$41	\$41
Operator & Land Return	\$347	\$322	\$352	\$348	\$340	\$315
Estimated Soil Loss (Tons/A)	0.68	0.63	1.93	1.83	1.62	2.21
GHG Emissions Metric Tons CO ₂ e/A	0.69		0.85			1.00

Assessing Tillage Performance by Year

- Consider all fields within a year – e.g. all High SPR Corn Fields from 2022 (HiSPRCorn,2022).
- Parse HiSPRCorn,2022 by tillage class
- Rank HiSPRCorn,2022 from least to most profitable (Operator and Land Return) and select the **Top 25% Most Profitable Fields** (Top25%MPF, HiSPRCorn2022)
- Parse Top25%MPF, HiSPRCorn2022 by tillage class



Assessing Tillage Performance by Year

- Compare values among tillage classes between the two datasets
- If the relative proportion for a tillage class is larger in the **Top25%MPF** than in the **full dataset**, that tillage class performed better than expected.
- If $>25\%$ of the fields from the full dataset are present in the **Top25%MPF**, that tillage class was well-represented among the most profitable fields.



Corn, High SPR, 2015 to 2024

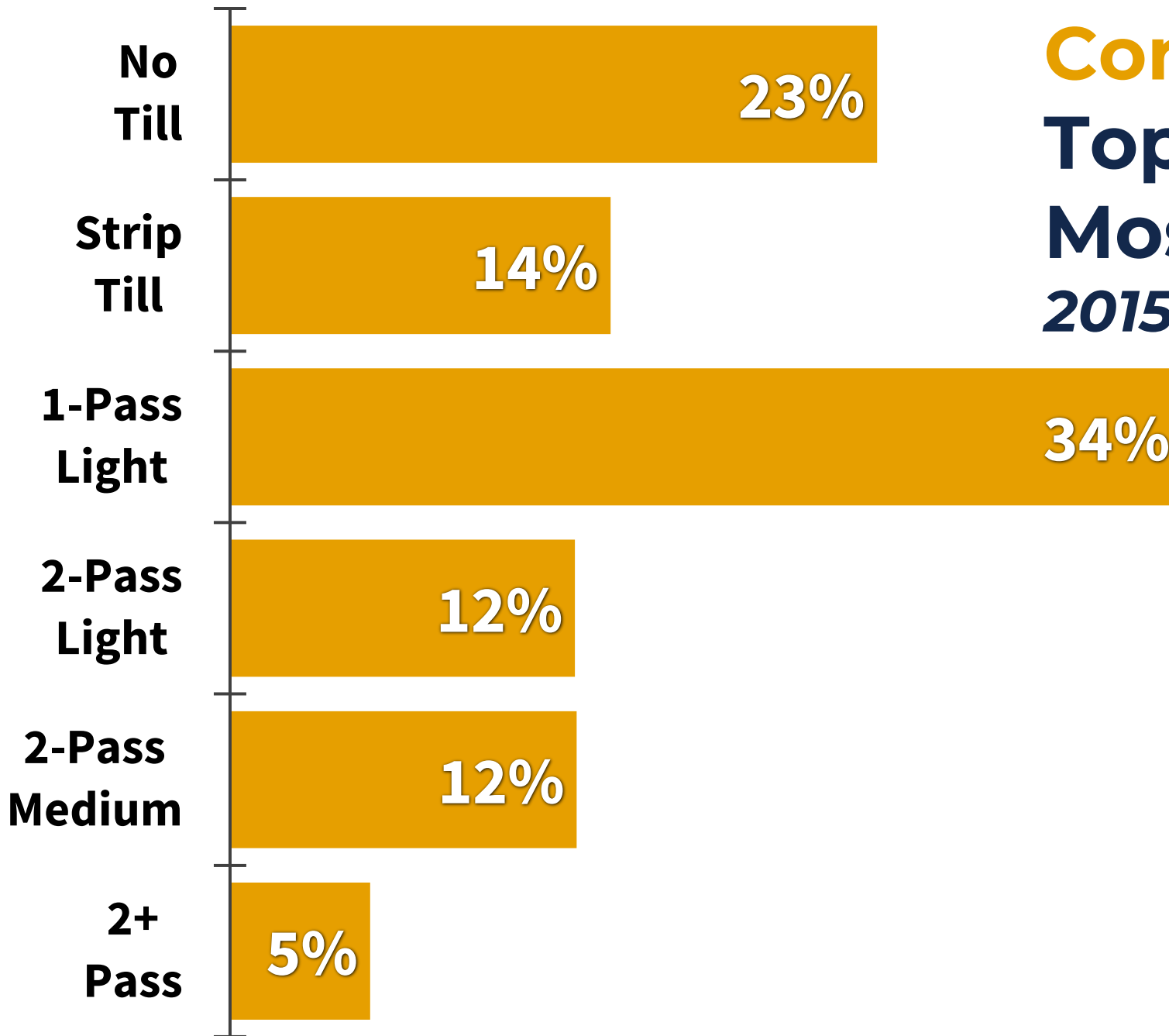
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Early Spring Conditions (northern/central IL)	Very Wet, Delays + replants	Warm, Dry, Early to Avg	Wet, Delays	Cool, Wet then Very Good	Wet Wet	Average To Wet, Some Delays	Variable Conds, Avg	Cool, Wet, Some Delays	Warm, Dry	Warm, Dry
In-Season Conditions	Wet/Poor to Avg	Very Good	Good	Very Good	Very Wet /Poor	Dry to Good	Good	Dry to Fair	Dry	Very Good
AVG YIELD all acres	204	227	223	234	209	218	223	233	234	245
August Corn Price	\$3.70	\$3.45	\$3.30	\$3.65	\$3.90	\$3.90	\$5.25	\$6.50	\$4.90	\$4.05
AVG PROFITABILITY -all acres	\$220	\$251	\$203	\$315	\$259	\$309	\$590	\$748	\$276	\$215
1-PASS LIGHT, % of all 1PL in Top 25%	25%	36%	24%	32%	24%	24%	24%	24%	28%	33%
STRIP-TILL, % of all ST in Top 25%	15%	35%	25%	24%	31%	26%	21%	20%	23%	21%
NO-TILL, % of all NT in Top 25%	14%	19%	34%	16%	20%	27%	21%	41%	34%	29%

No-Till was more profitable than expected in 4 out of 10 years, including the 3 most recent years

Corn Low SPR



Corn Low SPR
Top 25%
Most Profitable Fields
2015-2024



Corn Low SPR, 2015 to 2024 Average Values

	No-till	Strip Till	1-Pass Light	2-Pass Light	2-Pass Moderate	2+ Tillage Passes
Percent of Top 25% Profitable Fields 2015-2024	23%	14%	34%	12%	12%	5%
# Fields	1,913	1,013	1,610	541	686	220
Yield Per Acre	193	206	197	207	199	211
Gross Revenue	\$830	\$886	\$845	\$890	\$854	\$896
Total Non-land Costs	\$565	\$625	\$585	\$601	\$595	\$628
Total Direct Costs*	\$409	\$451	\$426	\$429	\$422	\$444
Total Power Costs	\$115	\$133	\$118	\$131	\$132	\$143
Field Work	\$0	\$21	\$12	\$26	\$28	\$40
Other Power Costs**	\$115	\$112	\$106	\$105	\$104	\$103
Overhead Costs	\$41	\$41	\$41	\$41	\$41	\$41
Operator & Land Return	\$265	\$261	\$261	\$289	\$259	\$268
Estimated Soil Loss (Tons/A)	0.9	0.69	1.3	1.34	1.41	1.81
GHG Emissions Metric Tons CO ₂ e/A	0.44		0.73			0.87

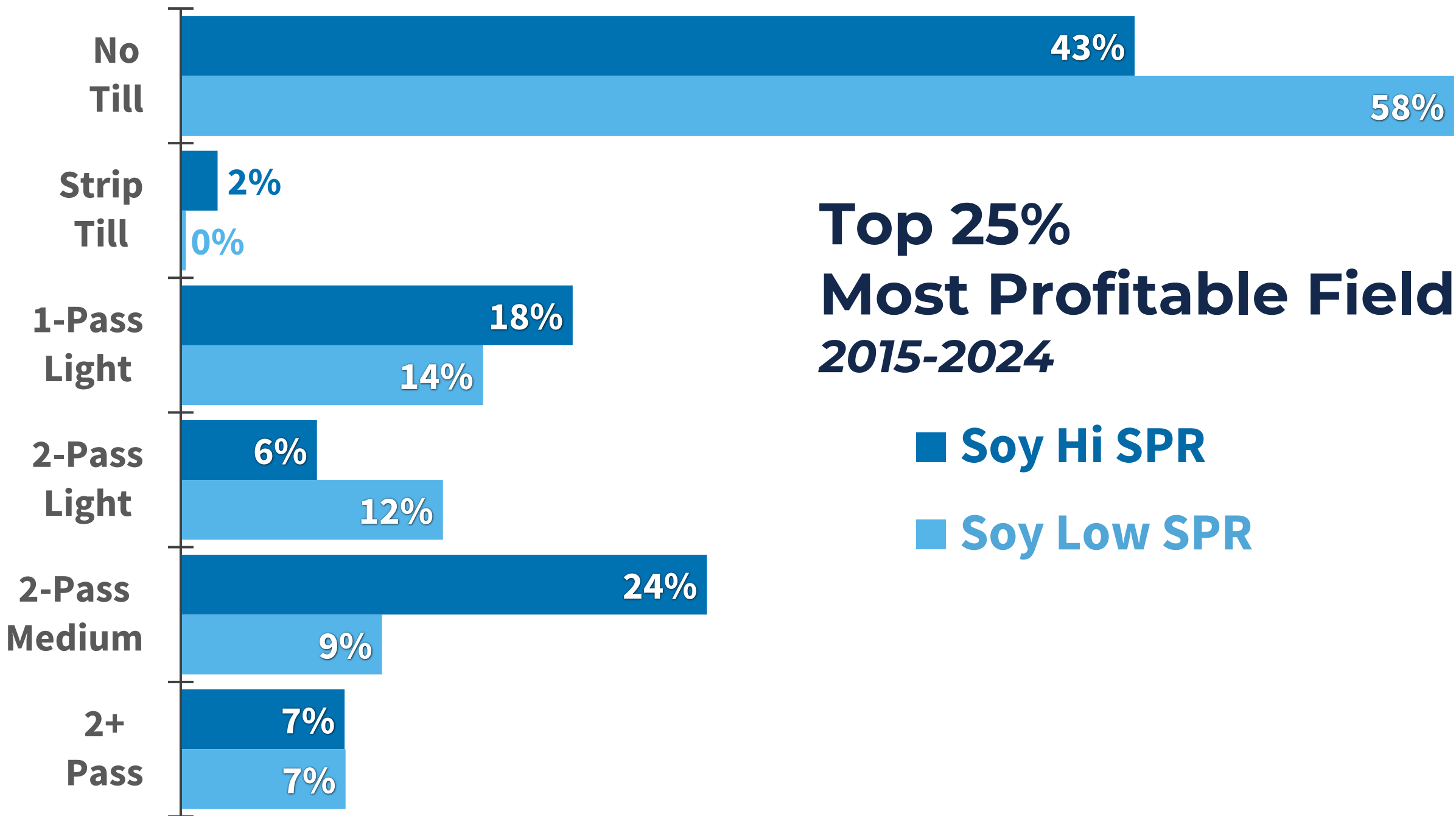
Corn, Low SPR, 2015 to 2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Early Spring Conditions (southern IL)	Warm, Dry-avg	Warm, Wet, Some Delays	Very WET, Very LATE	Cool, Wet, Avg	Extremely Wet, Extremely Late	Variable, Early with Replants	Variable, Early with Replants	Cool, Wet, Delayed	Dry April, May; Average	Wet April-May; Delays
In-Season Conditions	Wet, Cool/Poor	Very Good	Fair	Good	Very Wet /Poor	Good	Very Good	Fair to Poor	Dry/Poor	Very Good
AVG YIELD all acres	173	208	197	212	174	193	204	210	209	220
August Corn Price	\$3.70	\$3.45	\$3.30	\$3.65	\$3.90	\$3.90	\$5.25	\$6.50	\$4.90	\$4.05
AVG PROFITABILITY all acres	\$127	\$220	\$148	\$254	\$152	\$239	\$518	\$640	\$199	\$162
1-PASS LIGHT % of all 1PL in Top25	36%	49%	33%	23%	23%	28%	24%	17%	21%	24%
STRIP-TILL % of all ST in Top25	0%	36%	48%	9%	17%	25%	27%	34%	35%	28%
NO-TILL % of all NT in Top25	50%	6%	26%	24%	16%	23%	22%	28%	24%	29%

- **1-Pass Light** performed well in a low-price/lower cost environment (2015-2017).
- **Strip-Till** performed well in 5 of 10 years, including 3 most recent years.
- **No-Till** did well in 3 of 10 years.

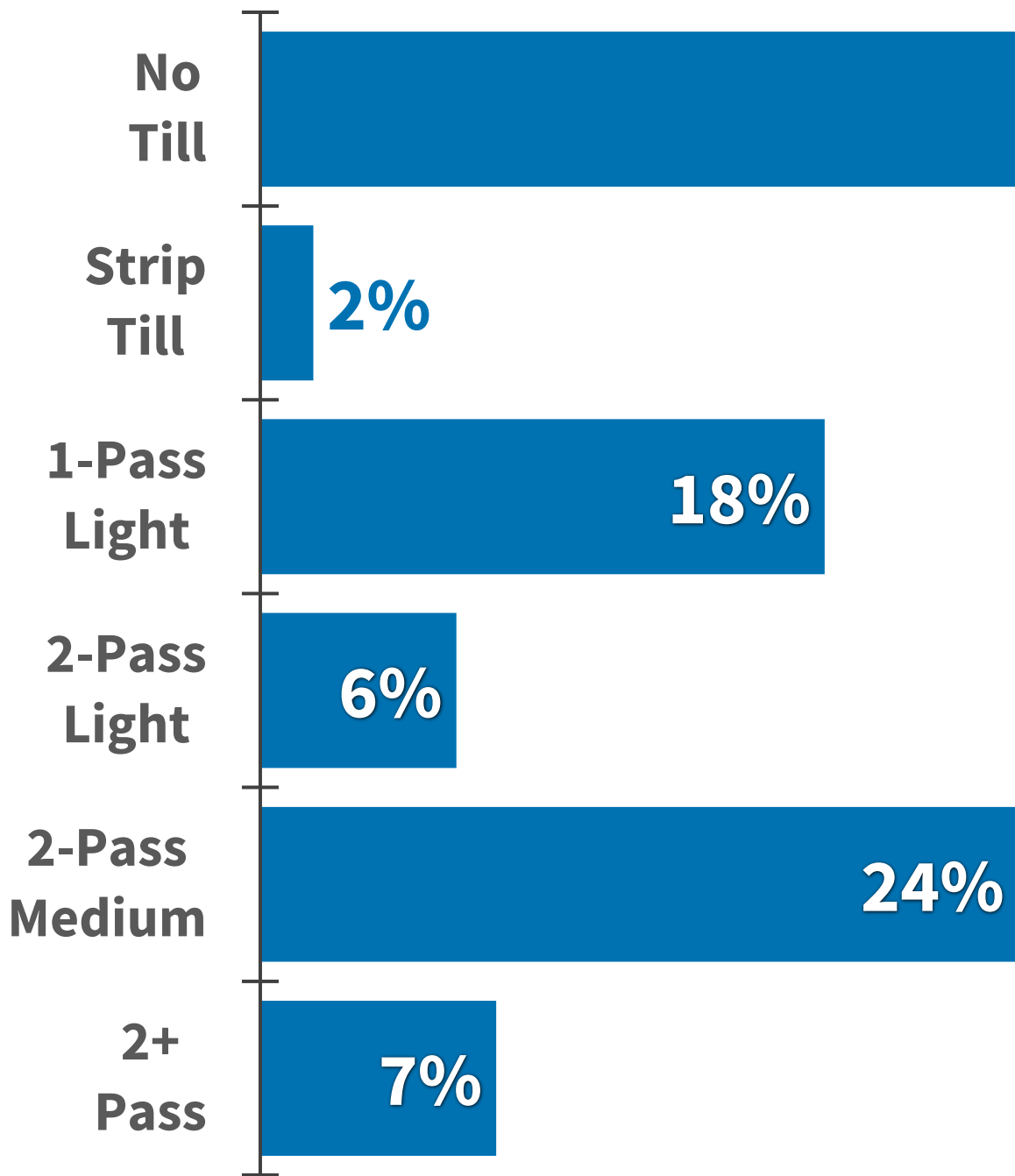
Soybeans





Soybeans High SPR





Soybeans High SPR
Top 25%
Most Profitable Fields
2015-2024

Soybean High SPR, 2015 to 2024 Average Values

	No-till	Strip Till	1-Pass Light	2-Pass Light	2-Pass Moderate	2+ Tillage Passes
Percent of Top 25% Profitable Fields 2015-2024	43%	2%	18%	6%	24%	7%
# Fields	3,691	263	1,146	352	1,103	514
Yield Per Acre	68	73	71	71	73	71
Gross Revenue	\$728	\$780	\$754	\$758	\$775	\$757
Total Non-land Costs	\$301	\$367	\$309	\$312	\$327	\$325
Total Direct Costs*	\$182	\$230	\$178	\$175	\$186	\$166
Total Power Costs	\$85	\$103	\$97	\$103	\$107	\$125
Field Work	\$0	\$20	\$13	\$27	\$29	\$50
Other Power Costs**	\$85	\$83	\$84	\$76	\$78	\$75
Overhead Costs	\$34	\$34	\$34	\$34	\$34	\$34
Operator & Land Return	\$427	\$413	\$444	\$446	\$448	\$432
Estimated Soil Loss (Tons/A)	1.24	0.76	1.86	2.47	2.74	4.46
GHG Emissions Metric Tons CO ₂ e/A	-0.1		0.05			0.17

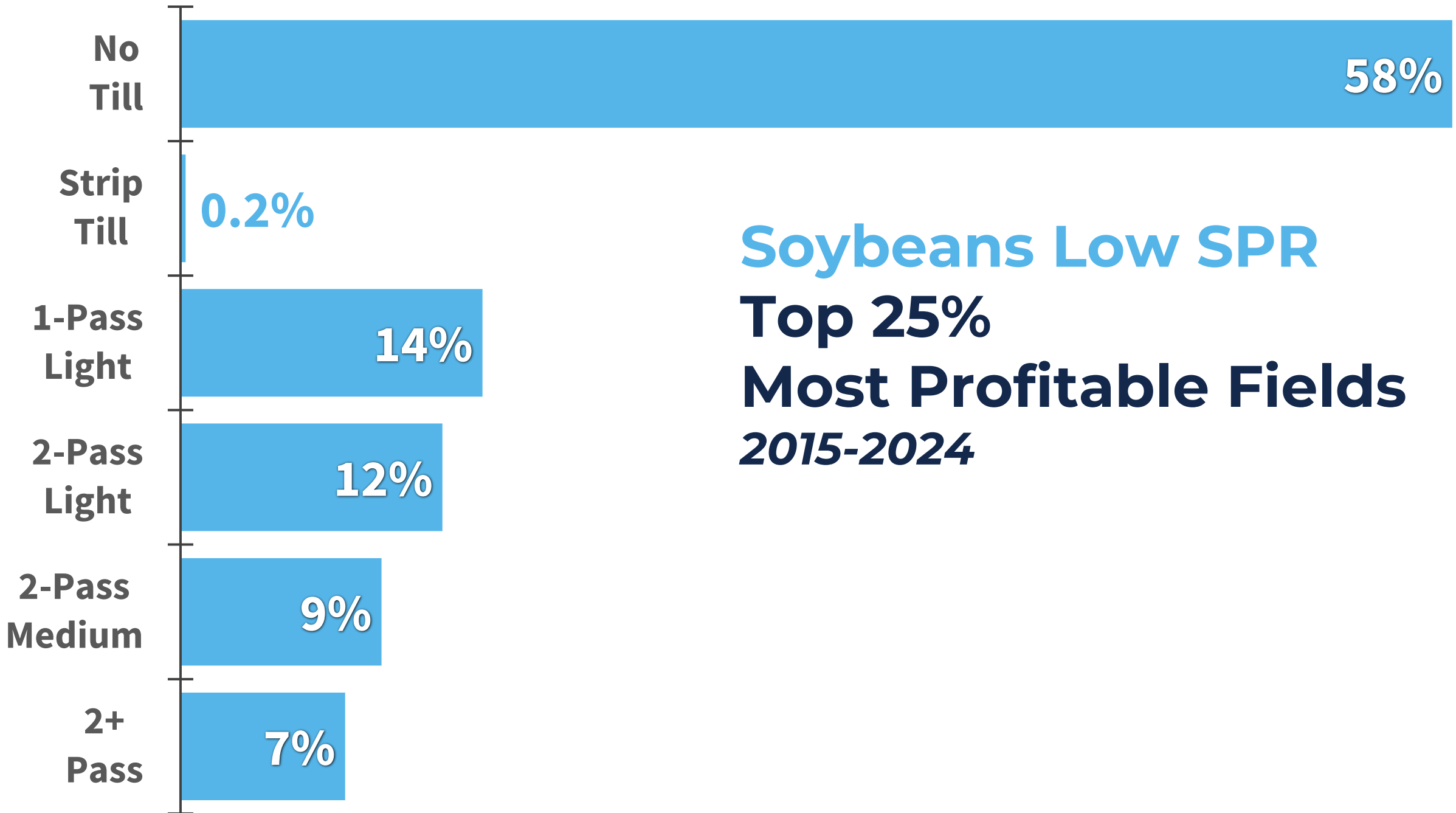
Soybean High SPR, 2015 to 2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Early Spring Conditions (northern/central IL)	Very Wet, Delays + replants	Warm, Dry, Early to Avg	Wet, Delays	Cool, Wet then Very Good	Wet Wet	Average to Wet, Some Delays	Variable Conditions, Avg	Cool, Wet, Some Delays	Warm, Dry	Warm, Dry
In-Season Conditions	Wet/Poor to Avg	Very Good	Good	Very Good	Very Wet /Poor	Dry to Good	Good	Dry to Fair	Dry	Very Good
AVG YIELD all acres	68	70	68	75	65	68	72	70	74	74
August Soy Price	\$9.20	\$9.80	\$9.30	\$8.50	\$9.25	\$10.00	\$12.75	\$13.50	\$13.00	\$10.60
AVG PROFITABILITY all acres	\$388	\$438	\$374	\$371	\$325	\$391	\$605	\$574	\$516	\$368
2-PASS MEDIUM % of all 2PM in Top 25%	20%	26%	35%	35%	38%	35%	44%	40%	42%	32%
NO-TILL % of all nt in Top25	24%	31%	25%	25%	24%	18%	17%	20%	19%	19%
STRIP-TILL % of all ST in Top25	0%	0%	30%	15%	14%	6%	9%	10%	17%	18%

2-Passes with a mix of heavier and lighter tillage equipment was strongest performing tillage strategy. Performed better than expected in 8 out of 10 years.

Soybeans Low SPR





Soybeans Low SPR
Top 25%
Most Profitable Fields
2015-2024

Soybean Low SPR, 2015 to 2024 Average Values

	No-till	Strip Till	1-Pass Light	2-Pass Light	2-Pass Moderate	2+ Tillage Passes
Percent of Top 25% Profitable Fields 2015-2024	58%	0.2%	14%	12%	9%	7%
# Fields	3,758	52	816	318	502	299
Yield Per Acre	62	65	61	64	65	64
Gross Revenue	\$658	\$762	\$657	\$684	\$692	\$686
Total Non-land Costs	\$295	\$382	\$301	\$305	\$313	\$312
Total Direct Costs*	\$175	\$212	\$174	\$170	\$177	\$161
Total Power Costs	\$85	\$132	\$93	\$101	\$102	\$117
Field Work	\$0	\$20	\$13	\$26	\$28	\$44
Other Power Costs**	\$85	\$112	\$80	\$75	\$74	\$73
Overhead Costs	\$34	\$34	\$34	\$34	\$34	\$34
Operator & Land Return	\$363	\$380	\$357	\$378	\$380	\$374
Estimated Soil Loss (Tons/A)	1.96	1.56	2.22	2.61	3.33	3.32
GHG Emissions Metric Tons CO ₂ e/A	-0.25		-0.01			0.16

Soybean Low SPR, 2015-2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Early Spring Conditions (southern IL)	Warm, Dry-avg	Warm, Wet, Some Delays	Very Wet, Very Late	Cool, Wet, Avg	Ext Wet, Ext Late	Variable, Early with Replants	Variable, Early with Replants	Cool, Wet, Delayed	Dry April, May; Average	Wet April-May; Delays
In-Season Conditions	Wet, Cool/Poor	Very Good	Fair	Good	Very Wet /Poor	Good	Very Good	Fair to Poor	Dry/Poor	Very Good
AVG YIELD all acres	63	65	59	67	55	58	64	64	64	64
August Soy Price	\$9.20	\$9.80	\$9.30	\$8.50	\$9.25	\$10.00	\$12.75	\$13.50	\$13.00	\$10.60
AVG PROFITABILITY all acres	\$354	\$398	\$311	\$314	\$249	\$312	\$512	\$492	\$403	\$274
1-PASS LIGHT % of all 1PL in Top 25%	43%	14%	10%	35%	16%	23%	25%	34%	24%	28%
2-PASS LIGHT % of all 2PL in Top 25%	36%	29%	33%	29%	26%	26%	50%	26%	12%	48%
NO-TILL % of all NT in Top 25%	14%	27%	32%	29%	26%	28%	23%	24%	24%	24%

- No stand-outs in recent years but **1-Pass Light** and **2-Pass Light** performed overall a little better than **No-Till** on lower SPR soils for soybean production.
- No-till can become competitive with incentive payments of \$10/a or more OR if producing a non-GMO or other higher value soybean.

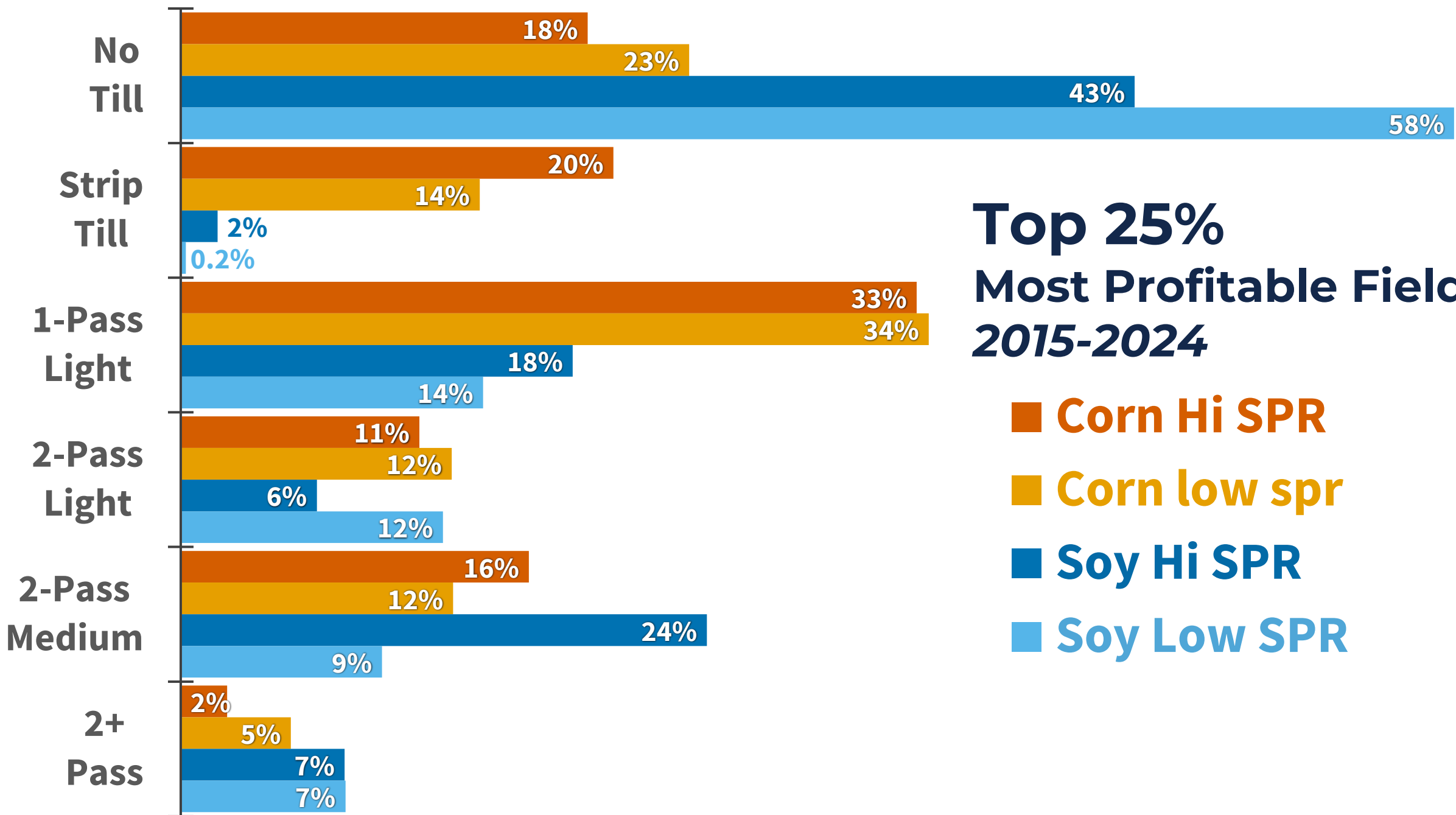
Summary



Summary

- For corn production on high SPR fields, no-till has been the strongest tillage strategy in recent years
- For corn production on low SPR fields, no-till and strip-till have been the strongest strategies in recent years
- We see 2 passes of tillage pay for itself in terms of higher yields for soybean production on high SPR soils
- For soybean production on lower SPR fields, 1-pass and 2-pass tillage systems can be profitable.





Top 25% Most Profitable Fields 2015-2024

- Corn Hi SPR
- Corn low spr
- Soy Hi SPR
- Soy Low SPR

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