

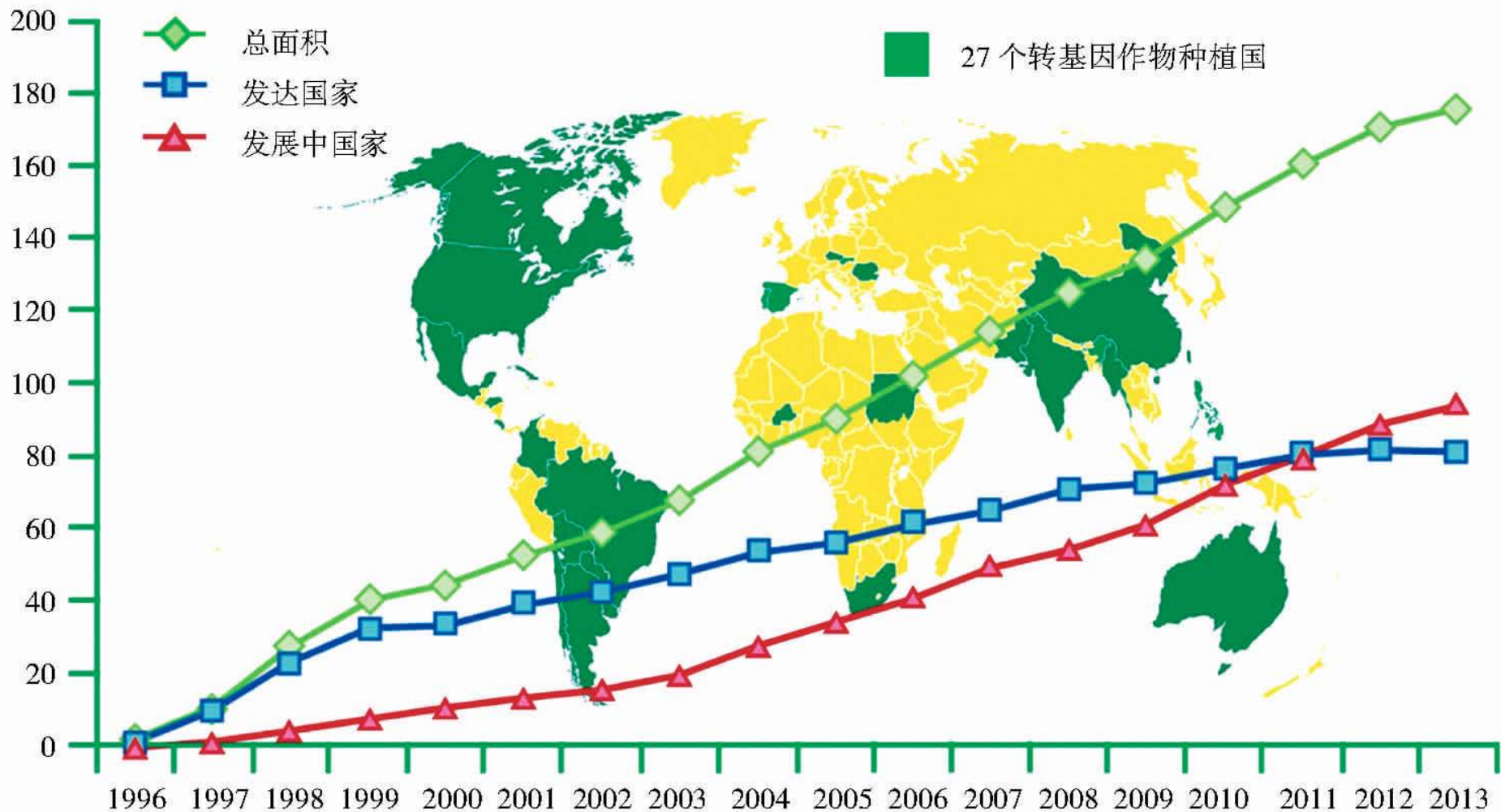


转Bt基因棉的种植对 农田害虫多样性的影响

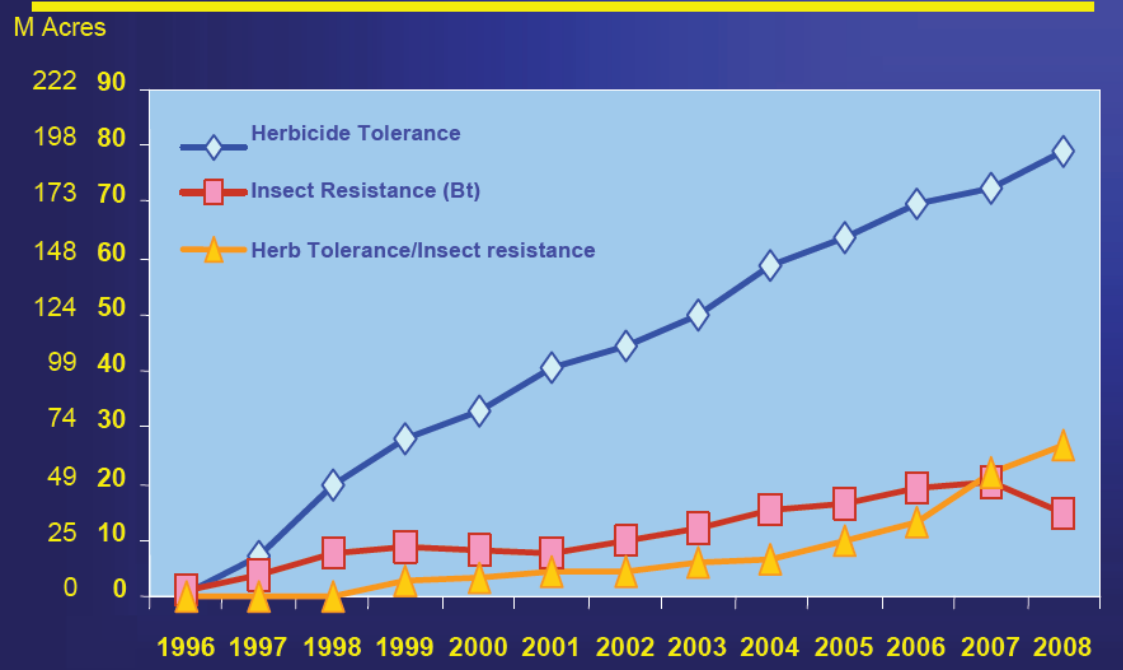
薛堃 雷元华 薛达元
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2014.08.14

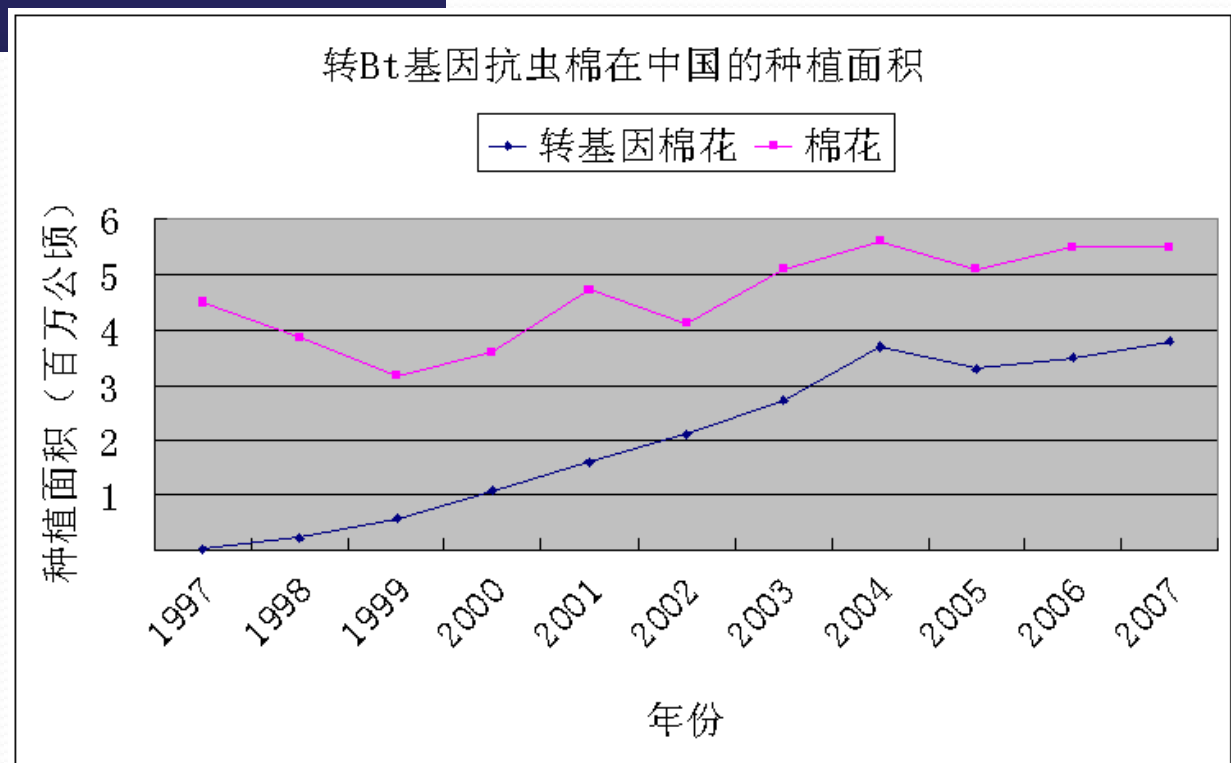
百万公顷 (1996年 - 2013年)

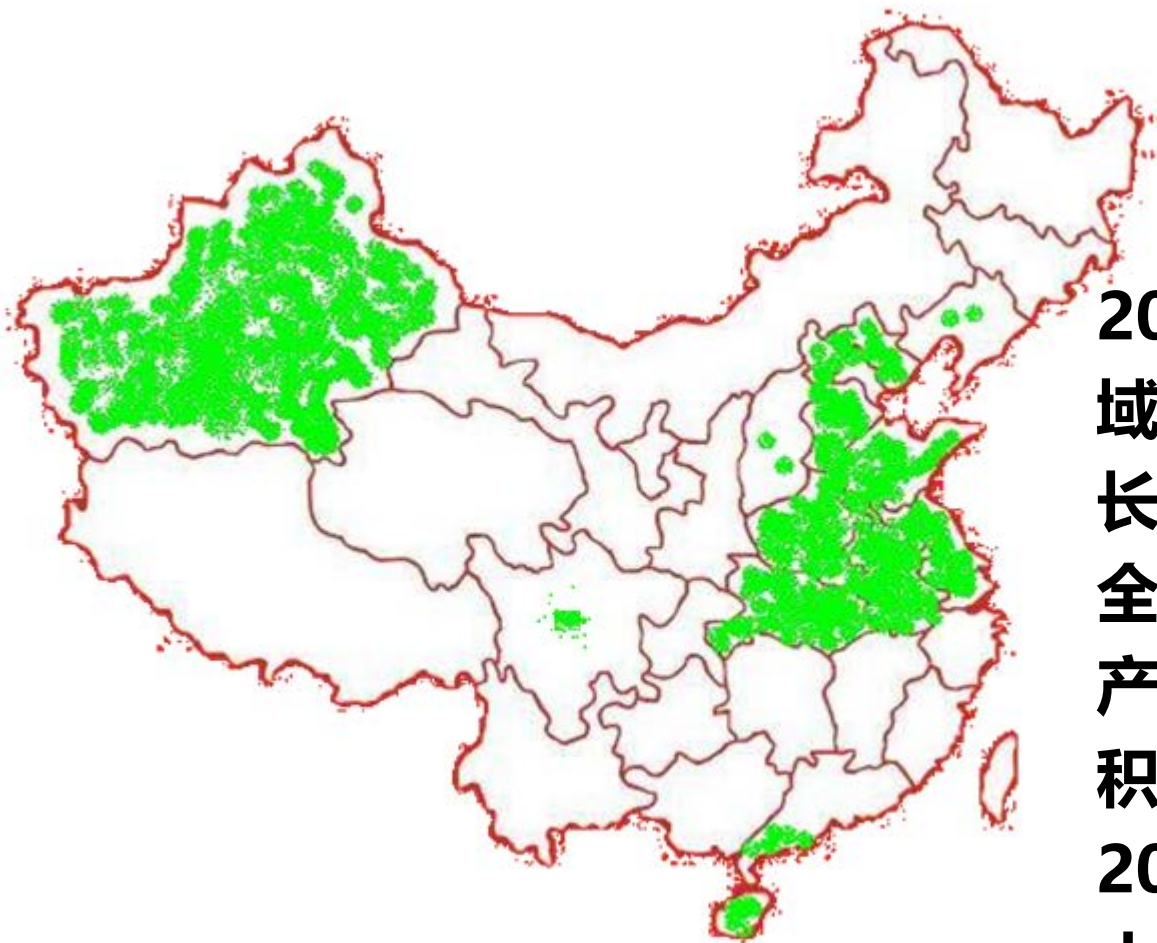


2013年，27个国家的1800万农民种植了1.753亿公顷(4.33亿英亩)的转基因作物，比2012年持续增长3%，即500万公顷(1200万英亩)。



虽然在世界范围内，转基因棉花的种植比例不高，但是我国自1997年批准转Bt基因棉商业化种植以来，Bt棉的种植面积在持续增加。





2008年抗虫棉在黄河流域棉区种植面积超过96%，长江流域棉区80%以上，全国种植面积达72%。国产抗虫棉占全国抗虫棉面积由1999年的7%增长到2008年的91%。河北、山东、河南、安徽等棉花主产省的国产转基因抗虫棉种植率达到100%。

研究方法

文献

转Bt基因棉

非靶标效应

大田研究

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467

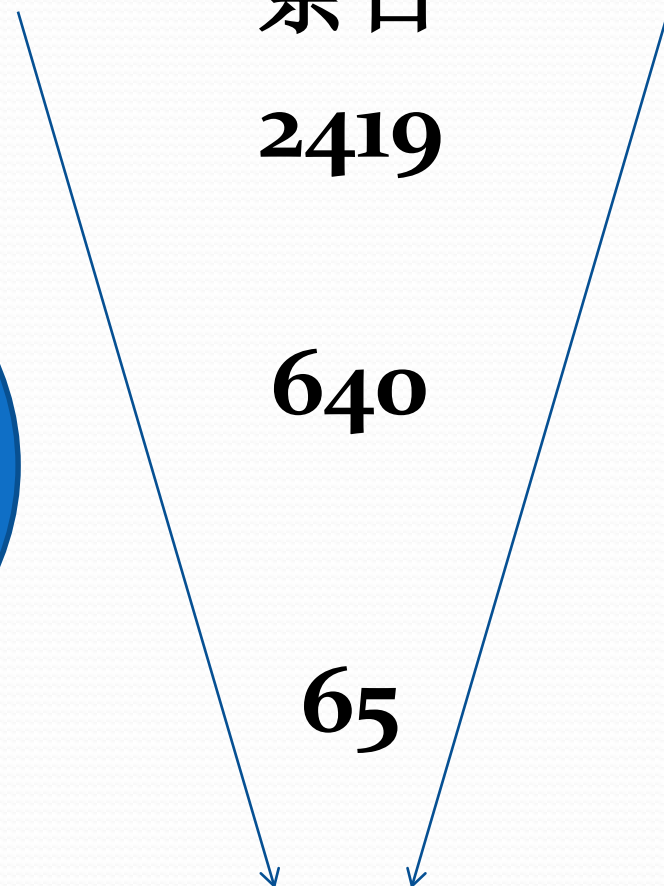
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条目

2419

640

65



研究结果（定性）

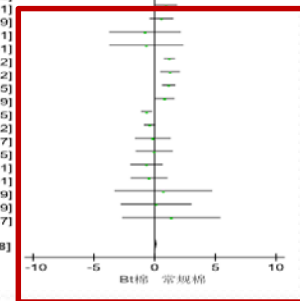
- 转Bt基因棉的种植引起农田生物种类、数量的变化；
- 转Bt基因棉的非靶标效应的研究目前以生态功能作为类群划分的标准；
- 转Bt基因棉田当中刺吸式害虫的变化是较好的研究对象

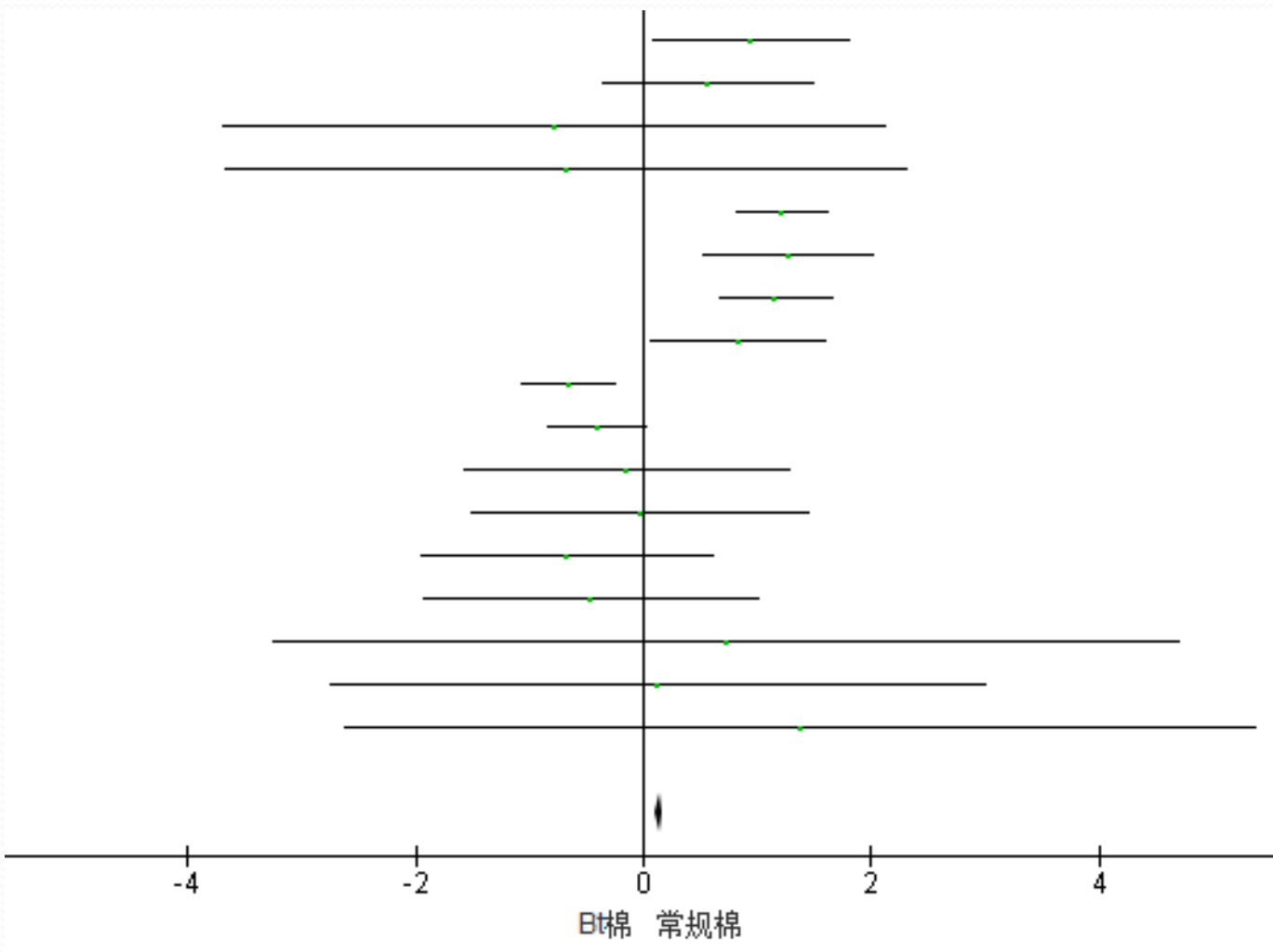


研究结果 (定量)

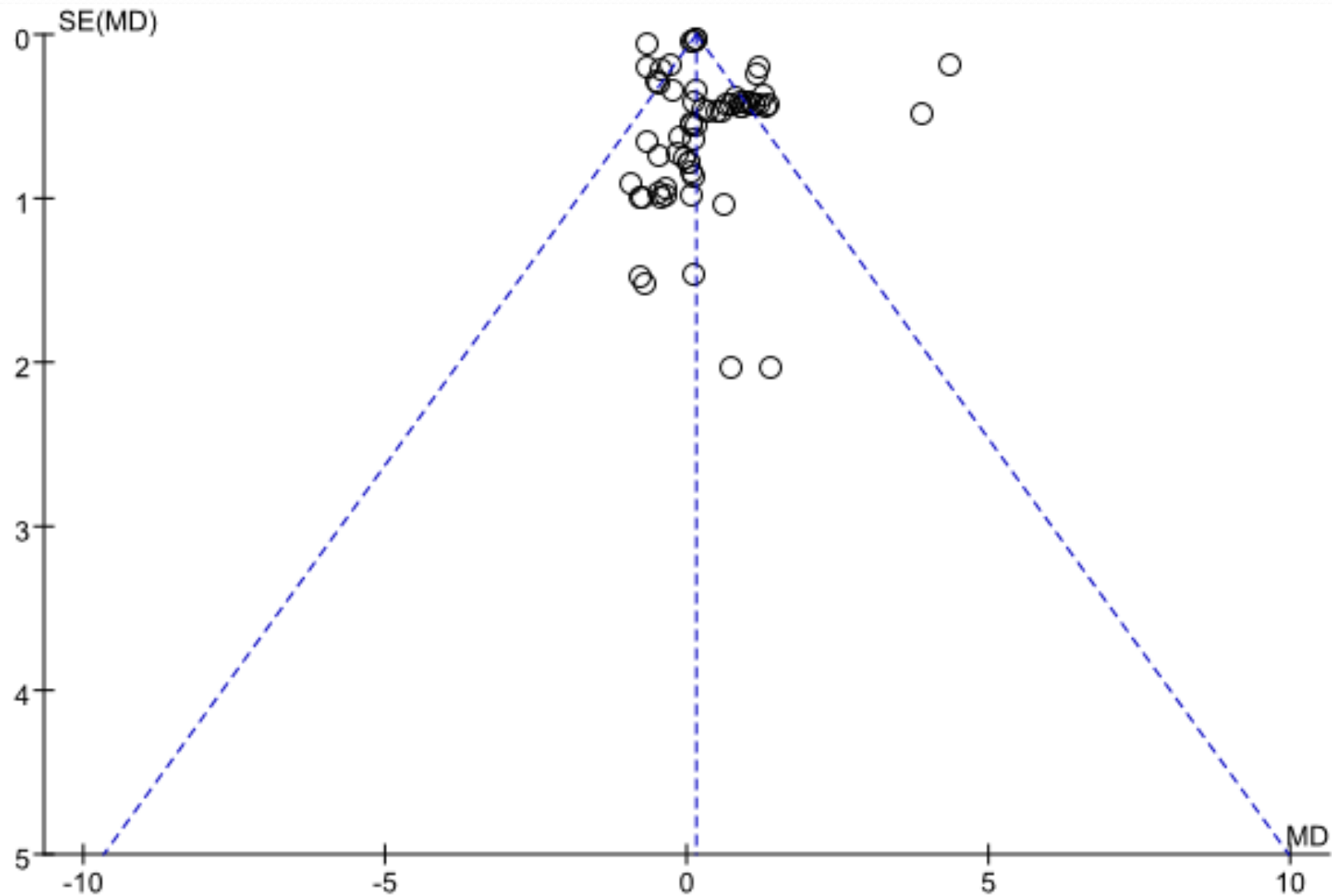
Study or Subgroup	低组			常规组			Weight	Mean Difference	
	Mean	SD	Total	Mean	SD	Total		IV, Fixed, 95% CI	IV, Fixed, 95% CI
1998cui1	7.149917	6.655569	100	7.499423	6.606515	100	0.0%	-0.35	[-2.19, 1.49]
1998cui2	5.545568	1.971299	100	1.20896	0.116534	100	0.8%	4.34	[3.95, 4.72]
1999cui	2.844909	0.916291	100	0	0	100	0	Not estimable	
1999wang	6.878429	4.610755	100	2.995732	1.673351	100	0.1%	3.88	[2.92, 4.84]
2000cui	7.122705	6.567699	100	7.908424	7.520636	100	0.0%	-0.79	[-2.74, 1.17]
2000zhang	7.178965	6.61079	100	7.908424	7.520636	100	0.0%	-0.73	[-2.69, 1.23]
2001sun	4.490041	0.301105	100	5.134765	0.597837	100	7.2%	-0.64	[-0.78, -0.51]
2001wu	3.200593	0.067659	100	2.83218	0.113329	100	0.0%	0.37	[0.34, 0.39]
2002bai	3.263467	2.921009	100	3.129826	2.90252	100	0.2%	0.13	[0.67, 0.94]
2002li	3.131516	1.427116	100	3.3848	1.203973	100	0.9%	-0.25	[-0.62, 0.11]
2002liu	4.276666	3.843316	100	4.207673	3.974434	100	0.1%	0.07	[-1.01, 1.15]
2002ma	3.957379	4.394819	100	4.071076	4.4533	100	0.1%	-0.11	[-1.34, 1.11]
2002pan	4.201254	4.619073	100	4.071076	4.4533	100	0.1%	0.13	[-1.13, 1.39]
2002shu	3.649359	3.929863	100	3.585739	3.813969	100	0.1%	0.06	[-1.01, 1.14]
2002song	3.736717	4.114474	100	3.585739	3.813969	100	0.1%	0.15	[-0.95, 1.25]
2002velders	7.735475	5.815032	100	7.684236	5.22104	100	0.1%	0.05	[-1.48, 1.58]
2002wang	1.960095	0.180001	100	1.791759	0.287682	100	28.2%	0.17	[0.10, 0.23]
2002wang2	2.028148	0.357563	100	1.931521	0.421262	100	10.6%	0.10	[-0.01, 0.20]
2003deng	3.78419	2.65926	100	3.637586	2.302585	100	0.3%	0.15	[-0.54, 0.84]
2003sun	3.583519	2.65926	100	3.828641	2.207275	100	0.3%	-0.25	[-0.92, 0.43]
2003wan	8.17976	7.72408	100	7.549241	7.080026	100	0.0%	0.63	[1.42, 2.65]
2003xu1	8.17976	7.72408	100	8.536996	6.026107	100	0.0%	-0.36	[-2.28, 1.56]
2003xu2	7.611842	6.919753	100	7.549241	7.080026	100	0.0%	0.06	[-1.88, 2.00]
2003zhou	7.611842	6.919753	100	8.536996	6.026107	100	0.0%	-0.93	[-2.72, 0.87]
2004cui	8.242414	6.165103	100	8.155764	5.687382	100	0.0%	0.09	[-1.56, 1.73]
2004qian	8.242414	6.165103	100	8.703009	7.514456	100	0.0%	-0.46	[-2.37, 1.44]
2004shi	8.288962	6.648466	100	8.155764	5.687382	100	0.0%	0.13	[-1.58, 1.85]
2004xu	8.288962	6.648466	100	8.703009	7.514456	100	0.0%	-0.41	[-2.38, 1.55]
2004zeng	7.730175	5.860644	100	7.675546	5.231536	100	0.1%	0.05	[-1.49, 1.59]
2004zhou	1.960095	0.180001	100	1.791759	0.287682	100	28.2%	0.17	[0.10, 0.23]
2005cui	2.028148	0.357563	100	1.94591	0.287682	100	15.4%	0.08	[-0.01, 0.17]
2005han	5.543614	1.252763	50	6.053265	1.646659	50	0.4%	-0.51	[-1.08, 0.06]
2005huang	5.581238	1.410987	50	6.053265	1.646659	50	0.3%	-0.47	[-1.07, 0.13]
2006zhang	5.399881	3.22446	100	4.342246	2.762538	100	0.2%	1.06	[0.23, 1.89]
2007chen	5.399881	3.22446	100	4.521136	2.658159	100	0.2%	0.88	[0.06, 1.70]
2007guo	5.399881	3.22446	100	4.75471	2.854169	100	0.2%	0.65	[-0.20, 1.49]
2007li	5.399881	3.22446	100	5.132145	3.337547	100	0.2%	0.27	[-0.64, 1.18]
2007li2	5.46806	3.314186	100	4.342246	2.762538	100	0.2%	1.13	[0.28, 1.97]
2007lian	5.46806	3.314186	100	4.521136	2.658159	100	0.2%	0.95	[0.11, 1.78]
2007zhang	5.46806	3.314186	100	4.75471	2.854169	100	0.2%	0.71	[-0.14, 1.57]
2008bai	5.46806	3.314186	100	5.132145	3.337547	100	0.1%	0.34	[-0.59, 1.26]
2008di	5.649467	3.471345	100	4.342246	2.762538	100	0.2%	1.31	[0.44, 2.18]
2008fu	5.649467	3.471345	100	4.521136	2.658159	100	0.2%	1.13	[0.27, 1.99]
2008li	5.649467	3.471345	100	4.75471	2.854169	100	0.2%	0.89	[0.01, 1.78]
2008wang	5.649467	3.471345	100	5.132145	3.337547	100	0.1%	0.52	[-0.43, 1.46]
2008xu	5.696456	3.376563	100	4.342246	2.762538	100	0.2%	1.35	[0.50, 2.21]
2009tan	5.696456	3.376563	100	4.521136	2.658159	100	0.2%	1.18	[0.33, 2.02]
2009zeng	5.696456	3.376563	100	4.75471	2.854169	100	0.2%	0.94	[0.08, 1.81]
2010chen	5.696456	3.376563	100	5.132145	3.337547	100	0.1%	0.56	[-0.37, 1.49]
2010jiang	8.226841	5.847305	30	9.014447	5.602119	30	0.0%	-0.79	[-3.89, 2.11]
2010mai	8.330864	6.197055	30	9.014447	5.602119	30	0.0%	-0.68	[-3.67, 2.31]
2011liu	8.286521	1.289233	100	7.07327	1.617406	100	0.8%	1.21	[0.81, 1.62]
2011ma	9.332558	2.761275	100	8.061487	2.639771	100	0.2%	1.27	[0.52, 2.02]
2011xiao	8.229511	1.936742	100	7.07327	1.617406	100	0.5%	1.16	[0.66, 1.65]
2011xu	8.885994	2.855895	100	8.061487	2.639771	100	0.2%	0.82	[0.06, 1.59]
2012chen	4.906755	1.252763	100	5.561451	1.648659	100	0.9%	-0.65	[-1.06, -0.25]
2012zhou	5.156754	1.410987	100	5.561451	1.648659	100	0.7%	-0.40	[-0.83, 0.02]
2012ma	7.602252	4.752728	100	7.749366	5.479805	100	0.1%	-0.15	[-1.57, 1.27]
2012wu	7.720506	5.167639	100	7.749366	5.479805	100	0.1%	-0.03	[-1.51, 1.45]
2012xiao	7.476982	3.817712	100	8.144998	5.286245	100	0.1%	-0.67	[-1.95, 0.61]
2012zhang	7.688593	6.275049	100	8.144998	5.286245	100	0.1%	-0.46	[-1.92, 1.01]
2013chen	12.14476	8.868554	30	11.42562	6.669957	30	0.0%	0.72	[-3.48, 4.98]
2013jiang	9.395159	6.318788	30	9.269835	4.92144	30	0.0%	0.13	[-2.74, 2.99]
2013li	12.14476	8.868554	30	10.77687	6.792232	30	0.0%	1.37	[-2.63, 5.37]
Total (95% CI)			5850			5850	100.0%	0.14	[0.10, 0.18]

Heterogeneity: Chi² = 802.68, df = 61 (P < 0.00001); I² = 92%
 Test for overall effect: Z = 7.78 (P < 0.00001)





——常规棉田刺吸式口器害虫数量明显多于Bt棉田

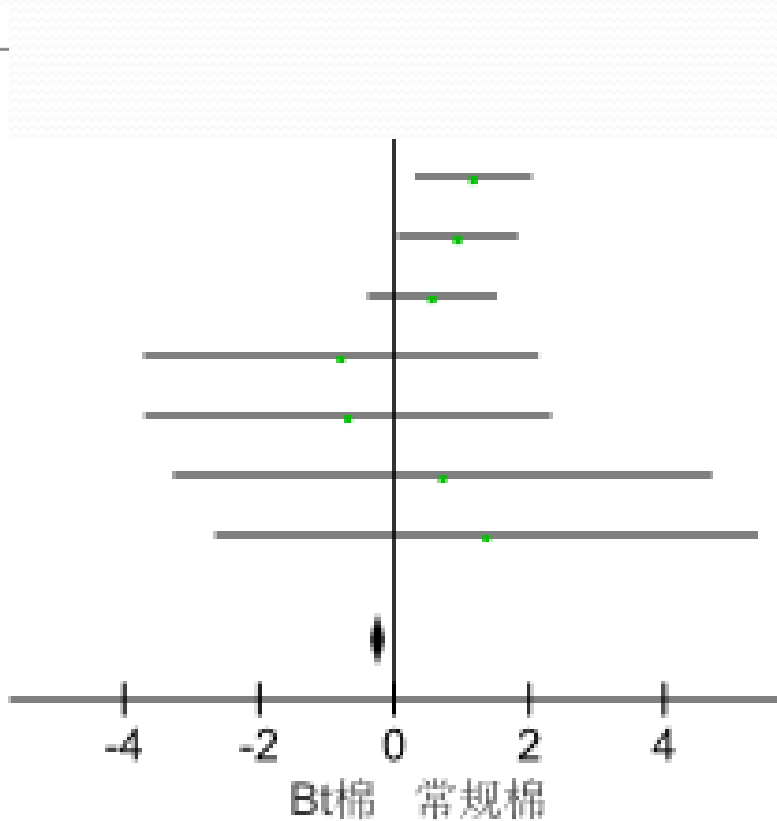
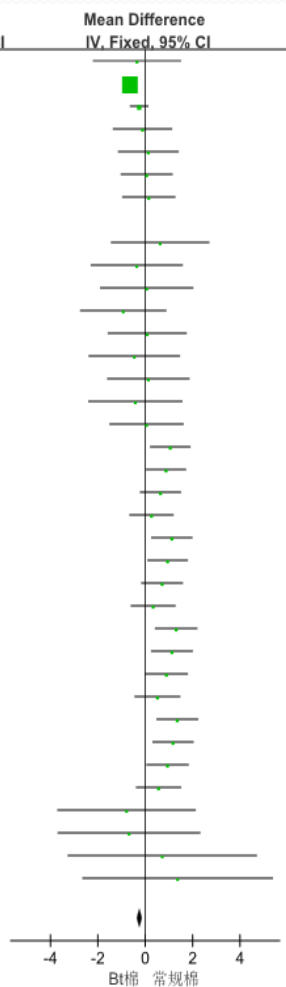


——没有发表偏好性！



Study or Subgroup	Bt棉			常规棉			Weight	Mean Difference		Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total		IV, Fixed, 95% CI	IV, Fixed, 95% CI	
1998cui1	7.149917	6.655569	100	7.499423	6.606515	100	0.3%	-0.35	[-2.19, 1.49]	
1998cui2	4.490041	0.301105	100	5.134765	0.597837	100	62.3%	-0.64	[-0.78, -0.51]	
1999cui	3.131516	1.427116	100	3.3848	1.203973	100	8.0%	-0.25	[-0.62, 0.11]	
1999wang	3.957379	4.394819	100	4.071076	4.4533	100	0.7%	-0.11	[-1.34, 1.11]	
2000cui	4.201254	4.619073	100	4.071076	4.4533	100	0.7%	0.13	[-1.13, 1.39]	
2000zhang	3.649359	3.929863	100	3.585739	3.813969	100	0.9%	0.06	[-1.01, 1.14]	
2001sun	3.736717	4.114474	100	3.585739	3.813969	100	0.9%	0.15	[-0.95, 1.25]	
2001wu	7.735475	5.815032	100	7.684236	5.22104	100	0.0%	0.37	[0.34, 0.39]	
2002bai	8.17976	7.72408	100	7.549241	7.080026	100	0.3%	0.63	[-1.42, 2.68]	
2002li	8.17976	7.72408	100	8.536996	6.026107	100	0.3%	-0.36	[-2.28, 1.56]	
2002liu	7.611842	6.919753	100	7.549241	7.080026	100	0.3%	0.06	[-1.88, 2.00]	
2002ma	7.611842	6.919753	100	8.536996	6.026107	100	0.3%	-0.93	[-2.72, 0.87]	
2002pan	8.242414	6.165103	100	8.155764	5.687382	100	0.4%	0.09	[-1.56, 1.73]	
2002shu	8.242414	6.165103	100	8.703009	7.514456	100	0.3%	-0.46	[-2.37, 1.44]	
2002song	8.288962	6.648466	100	8.155764	5.687382	100	0.4%	0.13	[-1.58, 1.85]	
2002velders	8.288962	6.648466	100	8.703009	7.514456	100	0.3%	-0.41	[-2.38, 1.55]	
2002wang	7.730175	5.860644	100	7.675546	5.231536	100	0.5%	0.05	[-1.49, 1.59]	
2002wang2	5.399881	3.22446	100	4.342246	2.762538	100	1.5%	1.06	[0.23, 1.89]	
2003deng	5.399881	3.22446	100	4.521136	2.658159	100	1.6%	0.88	[0.06, 1.70]	
2003sun	5.399881	3.22446	100	4.75471	2.854169	100	1.5%	0.65	[-0.20, 1.49]	
2003wan	5.399881	3.22446	100	5.132145	3.337547	100	1.3%	0.27	[-0.64, 1.18]	
2003xu1	5.46806	3.314186	100	4.342246	2.762538	100	1.5%	1.13	[0.28, 1.97]	
2003xu2	5.46806	3.314186	100	4.521136	2.658159	100	1.5%	0.95	[0.11, 1.78]	
2003zhou	5.46806	3.314186	100	4.75471	2.854169	100	1.5%	0.71	[-0.14, 1.57]	
2004cui	5.46806	3.314186	100	5.132145	3.337547	100	1.3%	0.34	[-0.59, 1.26]	
2004qian	5.649467	3.471345	100	4.342246	2.762538	100	1.4%	1.31	[0.44, 2.18]	
2004shi	5.649467	3.471345	100	4.521136	2.658159	100	1.5%	1.13	[0.27, 1.99]	
2004xu	5.649467	3.471345	100	4.75471	2.854169	100	1.4%	0.89	[0.01, 1.78]	
2004zeng	5.649467	3.471345	100	5.132145	3.337547	100	1.2%	0.52	[-0.43, 1.46]	
2004zhou	5.696456	3.376563	100	4.342246	2.762538	100	1.5%	1.35	[0.50, 2.21]	
2005cui	5.696456	3.376563	100	4.521136	2.658159	100	1.5%	1.18	[0.33, 2.02]	
2005han	5.696456	3.376563	100	4.75471	2.854169	100	1.4%	0.94	[0.08, 1.81]	
2005huang	5.696456	3.376563	100	5.132145	3.337547	100	1.2%	0.56	[-0.37, 1.49]	
2006zhang	8.226841	5.847305	30	9.014447	5.602119	30	0.1%	-0.79	[-3.69, 2.11]	
2007chen	8.330864	6.197055	30	9.014447	5.602119	30	0.1%	-0.68	[-3.67, 2.31]	
2007guo	12.14476	8.868554	30	11.42562	6.666957	30	0.1%	0.72	[-3.25, 4.69]	
2007li	12.14476	8.868554	30	10.77687	6.792232	30	0.1%	1.37	[-2.63, 5.37]	
Total (95% CI)			3320			3320	100.0%	-0.22	[-0.33, -0.12]	

Heterogeneity: Chi² = 151.65, df = 35 (P < 0.00001); I² = 77%
 Test for overall effect: Z = 4.24 (P < 0.0001)



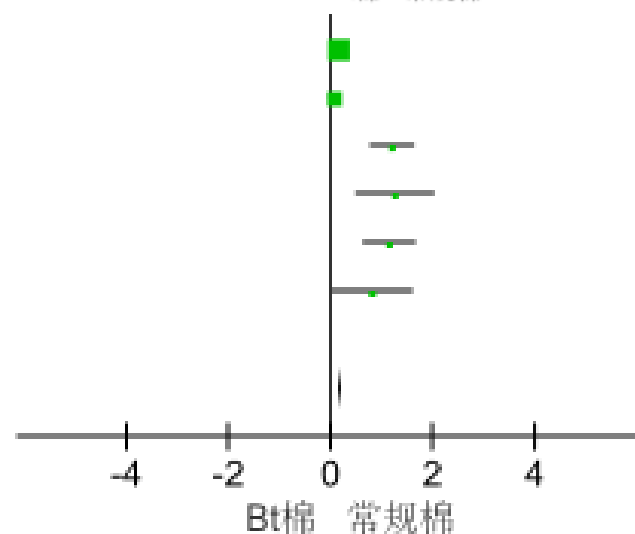
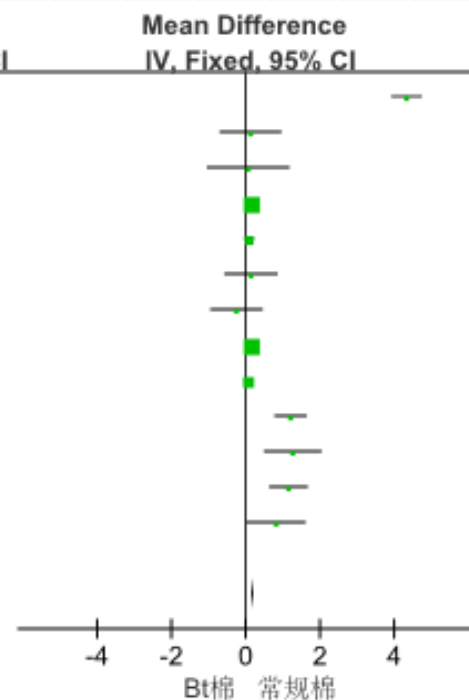
——Bt棉田蚜虫数量明显多于常规棉田



Study or Subgroup	Bt棉			常规棉			Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total			
2011luo	5.545568	1.971299	100	1.20896	0.116534	100	1.0%	4.34 [3.95, 4.72]	
2011ma	3.263467	2.921009	100	3.129826	2.90252	100	0.2%	0.13 [-0.67, 0.94]	
2011xiao	4.276666	3.843316	100	4.207673	3.974434	100	0.1%	0.07 [-1.01, 1.15]	
2011xu	1.960095	0.180001	100	1.791759	0.287682	100	32.9%	0.17 [0.10, 0.23]	
2012chen	2.028148	0.357563	100	1.931521	0.421262	100	12.4%	0.10 [-0.01, 0.20]	
2012luo	3.78419	2.65926	100	3.637586	2.302585	100	0.3%	0.15 [-0.54, 0.84]	
2012ma	3.583519	2.65926	100	3.828641	2.207275	100	0.3%	-0.25 [-0.92, 0.43]	
2012wu	1.960095	0.180001	100	1.791759	0.287682	100	32.9%	0.17 [0.10, 0.23]	
2012xiao	2.028148	0.357563	100	1.94591	0.287682	100	18.0%	0.08 [-0.01, 0.17]	
2012zhang	8.286521	1.289233	100	7.07327	1.617406	100	0.9%	1.21 [0.81, 1.62]	
2013chen	9.332558	2.761275	100	8.061487	2.639771	100	0.3%	1.27 [0.52, 2.02]	
2013jiang	8.229511	1.938742	100	7.07327	1.617406	100	0.6%	1.16 [0.66, 1.65]	
2013li	8.885994	2.855895	100	8.061487	2.639771	100	0.3%	0.82 [0.06, 1.59]	
Total (95% CI)			1300			1300	100.0%	0.20 [0.16, 0.24]	

Heterogeneity: $\text{Chi}^2 = 501.16$, $\text{df} = 12$ ($P < 0.00001$); $I^2 = 98\%$

Test for overall effect: $Z = 10.41$ ($P < 0.00001$)



——常规棉田盲蝽数量明显多于Bt棉田



讨论

文献反映的问题：

1. 定量研究占比较低；
2. 研究不规范；
3. 数据处理不规范；

讨论

结果反映的生物学意义：

1. 长期研究表明，转Bt基因棉对于非靶标植食者具有一定的作用；
2. 针对刺吸式害虫的荟萃分析结果表明，转Bt基因棉田中刺吸式昆虫数量有所下降，其中棉盲蝽（绿盲蝽、苜蓿盲蝽、中黑盲蝽、三点盲蝽、牧草盲蝽）和棉蚜贡献不同。



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谢谢!