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Utilization of Tobacco Sucker Control Agents in China

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ABSTRACT : Using sucker agents for tobacco can lead some advantages including saving labor, increasing yield and reducing the spread of diseases. At present, the sucker control agents used in China mainly depended on importing. The agents includes two groups, systemics (Maleic hydrazide: MH, etc) and partial systemics (Butralin, Flumetralin, Pendimethalin, etc). Now, Pendimethalin(a.i. 33%, wp) was used extensively all over the tobacco field in China. Sucker control agents will also be used for tobacco production in China. Because of the high price of the imported agents, China has studied on the domestic production of tobacco sucker control agents and has made some progresses.

Key words : China, tobacco, sucker control agents

1. The importance of the sucker control agents for tobacco

In order to increase the yield and to improved the quality of tobacco leaves, they needed topping. It could concentrate the nutrition which was used for the leaf growth (Wang and Shi, 1996). After topping, every sucker could reproduce 2~3 or more suckers. If letting them alone, they would consume much nutrition which would affect the leaves around main stem in growth and full body. Then the lugs' body will be light, the oil will be little, the flexibility will be bad, flavor and aroma will be decreased. Upper leaves will be small and thin. In the end the yield and the quality will be decreased (Tobacco Research Institute of Chinese, 1982). If we don't control the growth of suckers, the yield will lose 1% everyday (Wang and Shi, 1996). So, suckering on time was an important measure to

guarantee the yield and quality after topping. The manual suckering not only needs a lot of labor, but also infect disease easily. In order to overcome the weakness, man began to research and apply tobacco sucker control agents. Using tobacco sucker control agents was not only effective but also beneficial to its economical characteristics, yield, quality and inner chemical components, etc. After using tobacco sucker control agents, the areas of middle and upper leaves increase evidently, especially the upper leaves (Wang, 1992, 1996). The inner chemical components of tobacco leaves were nearer to the optimum value (Wang, *et al*, 1995). The inner chemical components of tobacco leaves were more harmonious, and then improved the quality.

2. The research on tobacco sucker control agents in China

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The research on tobacco sucker control agents started later in China. And the related research was little. In the 1950's, people did the experiments with kerosene Na_2CO_3 and kerosene colloid, etc., and found that they had certain effect. But if it was sprayed on a hot day of low humidity, it would burn axil heavily and made leaves drop off. The high humidity could cause axil to decay. So they were given up soon. Since 1981, the Henan Agricultural University started the experiments on normal Butanol (C_8) (Han *et al.*, 1982). Several years later, they manufactured the control agents No.1 successfully that mixed normal Butanol with some other materials. Its effect was good. The control agents No.1 could be used through painting or dripping. If painted with 6% No. 1 once, the sucker control effect could reach 94% (Han *et al.*, 1985). But the dripping had photo-toxicity and painting was not accepted easily by the farmers, so it was not in the extensive application. The Petroleum Chemistry Institute of Science College in Heilongjiang province studied the effect of normal decanol (In-D) from 1986. They once treated decanol the large areas in the Heilongjiang province (Zhao, 1991). But because of the bad smell, the short residual effect period and the extravagant time in painting, it was not be used. The experiment was also carried out on the effect of sucker control of Wu De-xi, a new tobacco biological sucker control agents, which were made from secondary metabolic product of *Botrytis cinerea*. It indicated that by using it once after the tobacco reached topping stage, it could control the growth of axil efficiently. The efficiency could reach 99% after 50 days. And it had no adverse effect to the growth of the tobacco plant. It could be used as a kind of biological tobacco sucker control agents (Wu *et al.*, 2000).

3. The kinds of tobacco sucker control agents in China

At present, there are three kinds of tobacco sucker control agents in China. Those are systemics, partial systemics and contacts.

3.1. The systemic tobacco sucker control agents

Maleic hydrazide(MH) is the main systemic tobacco sucker control agents. Now the application focused on its potassium salt and chlorine salt. MH was dropped on the tobacco leaves, then absorbed and carried to the growth points of tissues that grow animated. So it could restrain the activity of meristem, and then restrained the growth of sucker. The efficacy of MH was longer than 20 days. When the consistency was higher, it could restrain the sucker to grow until harvest only by using once. MH not only had good effect on sucker control, but also could increase yield compared with manual suckering. At the same time the quality could be improved. But the cigarette industry argued that MH treatment would decrease the nicotine contents, and increase the equilibrium moisture and sugar contents. All these things would bring side effect. The results of Wang Feng-long's experiment showed that MH could increase yield and products value. The analysis result about inner chemical components could be seen in Table 1. The nicotine and protein contents in the tobacco leaves were lower compared with manual suckering, and potassium was higher than manual suckering (Wang, 1996).

The relative stability of MH causes more residue in the tobacco. MH also faces the problems of toxicity and residue. But there is not enough evidence to prove that MH is poisonous in toxicology. Some persons think the ethylene

Table 1. The analysis of inner chemical components in tobacco leaves (Qingzhou, Shandong in 1994)

Treatment	Reducing sugar (%)	Total sugar (%)	Nicotine (%)	Total nitrogen (%)	Protein (%)	Shumk quality index	K ₂ O (%)	Cl (%)	K/Cl
MH, potassium salt, 60x	17.27	24.05	2.63	1.87	8.84	2.72	1.30	0.95	1.4
Pendimethalin, 100x	16.66	23.17	2.43	1.72	8.10	2.86	1.33	1.26	1.1
Manual suckering	16.37	23.75	3.19	2.04	9.31	2.55	0.93	0.69	1.3

glycol amine salt of MH has latent toxicity, but its potassium salt and chlorine salt does not have latent toxicity. So MH was used in many countries including China. At present the main systemic tobacco sucker control agents are 25% MH, 30.2% potassium salt of MH and 58% potassium salt of MH etc.

3.2. The partial systemic tobacco sucker control agents

Most of partial systemic tobacco sucker control agents are combination of nitro-aniline. It has two effects which are contact and systemic. It mainly restricted the cell division of sucker growth point. The function is strong and the residue is small. Its effect was reliable and it benefited the yield, product value and inner

quality. At the same time it was safe to tobacco. It was used widely. The area which use partial systemic tobacco sucker control agents extended quickly in China. At present 25% Flumetralin (prime+250 EC), 33% Pendimethalin (ACCOTAB330E) and 36% Butralin (Tamex360E) were used widely. The effect of above sucker control agents on sucker control and influence for inner chemical components could be seen in Table 2 and Table 3 (Wang and Shi, 1996).

3.2.1. Flumetralin (prime+250 EC)

Painting 350x Flumetralin, the effect of control suckers could reach 99.6% at 2 weeks later (Table 2). And it could restrain the sucker to grow until harvest only by using once. It could not only increase the yield, product value and

Table 2. Effects of three kinds of sucker control agents on sucker control

Sucker control agents	Dilution rate	Province, Crop year	Effects of sucker control (%)		
			Weeks after chemical treatment		
			2	4	6
Flumetralin	350x	Hunan, 1987	99.6	-	-
Pendimethalin	100x	Shandong, 1992	>95.0	-	>90.0
Butralin	100x	Shandong, 1993	97.6	97.6	92.8

Table 3. Effects of three kinds of sucker control agents on chemical components of cured leaves

Treatment	Reducing sugar (%)	Total sugar (%)	Nicotine (%)	Total nitrogen (%)	Protein (%)	Shunk quality index	K ₂ O (%)	Cl (%)	K/Cl
Flumetralin	22.1	24.4	3.18	1.65	8.33	2.92	-	-	-
Manual suckering	23.1	25.0	1.81	1.82	8.21	3.05	-	-	-
Pendimethalin	15.0	22.4	1.46	1.42	1.27	3.08	1.18	2.80	0.40
Manual suckering	18.3	26.4	1.19	1.19	6.09	4.33	1.42	3.20	0.40
Butralin	18.4	23.6	3.01	1.96	9.00	2.62	1.23	0.71	1.73
Manual suckering	14.9	20.4	3.01	1.90	8.63	2.73	1.14	0.70	1.63

superior leaf proportion, but also could make the inner quality and some chemical components better (Table 3).

3.2.2. Pendimethalin (ACCOTAB330E)

It was introduced in 1988 and applied in the tobacco field. The applied area was already 80,000 hectares in 1992, spreading all over the country. The effect of control suckers could reach above 95% by the dripping with 100x Pendimethalin 2 weeks later. Then it could reach above 90% 6 weeks later. It could control the growth of the suckers effectively. After using Pendimethalin with 100 times, 2 weeks later we observed that Pendimethalin could increase the area of the middle and upper leaves. It could improve yield and product value, and the inner chemical components being similar to the superior leaf. So it could ensure and improve the quality of leaf (Table 3).

3.2.3. Butralin (TAMEX 360E)

The effect of cup dripping of 100x Butralin could reach 97.6%. It could be above 92.8% 6 weeks later (Table 2). The effect was very evident. It could restrain the sucker to grow until harvest only by using once. Using Butralin could

increase the area of the middle and upper leaves. It could increase the yield, product value and the content of potassium. It was beneficial for improving the burning of tobacco (Table 3).

3.2.4. Dilution rate and methods of using the partial systemic agents

In the condition of medium soil productivity, abundant fertilizer and vigorous growth, the best dilution rate of 25% Flumetralin was 340~400 times. Those of 33% Pendimethalin and 36% Butralin was 80~100 times, and the best was 100 times of dilution rate. The diluted rate should be decided according to the soil fertility, fertilization and tobacco plant type. Feng Zhu-an put 0.1~0.3% detergent into Flumetralin whose dilution rate was 700~1500 times. As a result, its effect of sucker control, productivity and rate of dry weight by fresh weight were basically comparable to those of Flumetralin whose dilution rate being 500 times (Feng, 1994). All these indicate that active solvent could decrease the application amount by 1/3~2/3. So it could decrease the cost.

The applying methods of the partial systemic agents could be amended by the cultivation area, available labor forces and growing seasons etc.

Table 4. The areas using tobacco sucker control agents in China in 2000

	Total	Yunn- an	Guiz- hou	Hen- an	Hun- an	Fuji- an	Shan- dong	Chong- qing	Sha- nxi	Heilong- jiang	Hu- bei
Cultivation area, 10 ⁴ ha	97.7	29.6	15.9	10.4	5.5	4.4	4.4	4.0	3.8	3.7	3.5
Using area, 10 ⁴ ha	48.8	17.2	5.6	1.7	2.1	4.4	2.6	3.3	1.4	3.7	0.8
% using area	50.0	58.1	35.2	16.3	38.2	100.0	59.1	82.5	36.8	100.0	22.9

In the average cup dripping was thought better in most areas. This method had some advantages, such as faster in application, saving labor and material, and the lower cost etc. The cost of pen painting was the lowest, and the effect was good. But the speed was slow and consumed many labors, so farmers hardly accept it. It made the spread area smaller. Though the spraying fog in low pressure could save labors, but the application amount was large, and the cost was higher.

4. The situation of using tobacco sucker control agents in China

In most areas tobacco growers are accustomed to hand suckering, the chemical suckering by using the sucker control agents is practiced very slowly (Table 4). The area using sucker control agents was 488,000 hectares. It is 50% of total cultivation area. Among the area using sucker control agents, in Fujian, Heilongjiang province and Chongqing city were over 80%. The area of Yunnan and Shandong province was over 50%. And the area of other province was very small.

5. The future of tobacco sucker control agents in China

At present, most of the tobacco sucker control

agents used in China are imported. Its price is much higher than that of domestic products. That interferes the spread and application. So the researching and manufacturing domestic sucker control agents is urgent in order to decrease the suckering cost. Recently, there are great progress on the researching and manufacturing the sucker control agents in China. The effect of domestic products on sucker control is comparable to that of the imported ones, such as Pendimethalin. As a conclusion, the business of tobacco sucker control agents has a great future in China (Chen *et al.*, 2002).

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