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Drift in sprayers and effects of weather conditions on drif

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ABSTRACT: Attention to the safety and environmental issues in all sectors of agriculture, industry and services in different countries is important. In the agriculture, each year many efforts has been done to find alternatives methods, but millions liters of toxic substances for control pests are uses, each year. Pesticide spraying drift at during or afterwards spraying to the non-target is an important issue for manufacturers and users of sprayer. Complete removal the drift is not possible, Therefore, with providing management solutions such as choosing the right chemicals, efficient use of amount of pesticide consumption, drift affecting factors and proper operation of spraying equipment in the favorable weather conditions can be minimized drift.

***Keywords*:** Drift, Environmental, sprayers and weather conditions

INTRODUCTION

The use of chemical pesticides in agricultural production, have a major role. By Using these toxins, the quality and quantity of product increased and by use the machine sprayers, the labors to control the weeds and pesticides is reduce (Shafiee, 2008). Each year, about 25 to 35 percent of the world's crops by insects, weeds and plant pathogens are destroyed and If does not fight up, increase to 80%. With considering the above text, the pest control is necessary (Anonymous, 2011). Moving the pesticides by wind from spraying location to the non- target called drift. The affecting factors on drift included droplet size produced, spraying pressure, nozzle diameter, forward speed, wind speed, humidity, temperature and sprayed liquid Viscosity (Peyman et al., 2011 and Peyman et al., 2010). But in the range of agricultural applications, the Viscosity and density of the liquid have a little effect on droplet size (Serivastava et al, 2007).

According to the influence factors on the drift and by considering to the consequences of drift, negative Environmental Effects due to weather conditions on drift is necessary.

Drift percentage in sprayers

Safari et al (2009) by evaluation common sprayers in the wheat fields Concluded that the turbo liner sprayer with 46.3% have a most drift, In comparison microner and atomizer sprayers with 36.4% and 14%, respectively. But Safari et al (2011) Concluded that the microner sprayer with 43.6% have a most drift, In comparison Conventional atomizer and boom atomizer sprayers with 27% and 8.3% respectively.

In the experiment by air induction boom sprayer, boom tractor sprayer, atomizer, microner and turbo liner sprayers was evaluated. Concluded that the most drift was for the turbo liner sprayer with 39.13% and the lowest drift was for the air induction boom sprayer with 1.5%. Also the highest amount of pesticide sediments on plant was

for the air induction boom sprayer with 94.1% and the lowest drift was for the atomizer sprayer with 62.85% (Safari et al, 2013).

The effect of weather conditions (wind, humidity and temperature) on the potential drift

In the study by Nuyttens et al. (2006) investigated the interaction of temperature and relative humidity on the drift Which shows a strong correlation between temperature and relative humidity are in accordance with Figure 1, that reduced the drift levels with reduce the temperature and humidity Increases. For example, at a distance of 5.0 meters, on a relative humidity of 50% and a temperature of 20.1 ° C. In comparison with RH= 70% and T=16.70C, declined the drift rate from 19.8% to 15.6%.

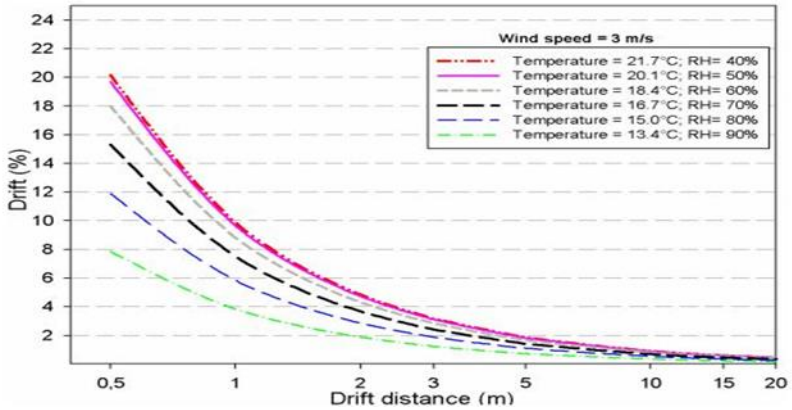

Figure 1. Effect of temperature and relative humidity at fixed wind speed on the drift

Balsari et al. (2007) A test carried out on the drift by two flat fan T-Jet nozzles (Teejet XR 11003) and air induction T-jet nozzles, they Concluded that with temperature increases and low humidity, drift potential and toxic sediments (microliter per square centimeter) outside from the scope of spraying is reduced, According to Figure 2:

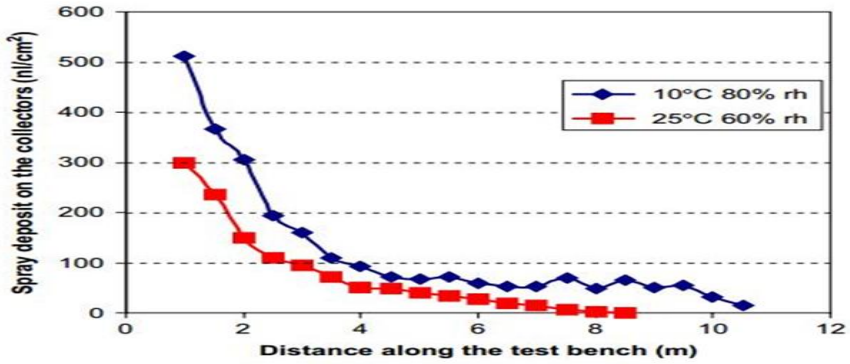

Figure 2. The effect of temperature and humidity on the rate of pesticide sediments

The effect of wind speed on the potential drift

Based on the results of research, Wind speed has a significant effect on the amount of evaporation losses and drift, Average losses in the amount of wind speeds greater than 4 meters per second, were approximately 25% that More than 2 equal the amount of losses in the range of wind speeds of less than 2 meters per second (Average losses of 9%) (Erfanian et al., 2009).

Nuyttens et al (2006), examine the Climatic conditions on the drift and concluded that wind speed increases causes that the drift rate increases, for example, At a distance of 5.0 meters from the spraying pesticides, With increasing wind speed of 3 meters per second to 5 meters per second, drift increases from 16.8 percent to 18.9 percent, According to Figure 3:

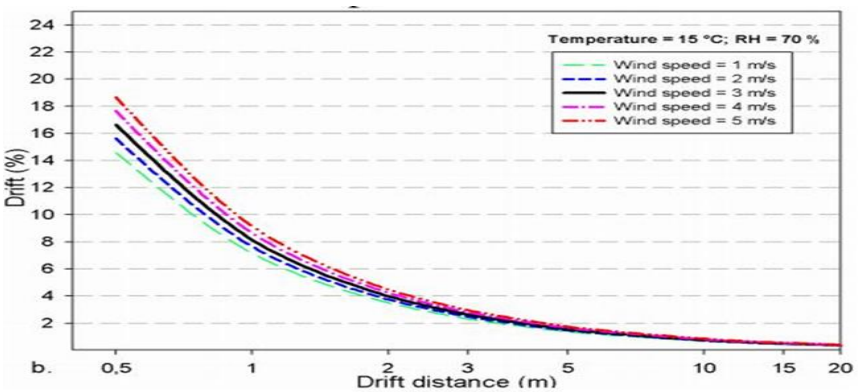

Figure 3. Effect of wind speed on the drift

Piche et al (2000) By studying the boom hydraulic sprayer with conventional and air induction systems concluded that Wind speed increase of 1 meter per second to 5 meters per second, drift rate increases. Drift for two conventional sprayers and Air Induction sprayer, in 1.07 meter per second wind speed, 2.81 and 0.26 percent Respectively, In 3.11 meters per second wind speed, 8.42% and 0.51% respectively, and in 4.97 meters per second wind speed, drift rate was 9.44% and 0.39%, that drift further reduces with the coarser particles of induction air sprayer.

Gulyas et al (2011) by studying the rate drift in tunnel wind concluded that with increasing wind speed, deposited from drift Increased. The percentage of droplets smaller than 100 microns was classified as "very fine", "fine", "middle" and "coarse". In the wind speed 4 m/s , Covering percentage for particles "very fine" and "fine" were 3% and 4% respectively. ". In the wind speed 6 m/s, covering percentage for particles "very fine" and "fine" were 7% and 4% respectively.

Based on the results of research for the wind speed and wind direction, with increasing wind speed (wind direction is from the front), further the spraying In the Petri dish and therefore drift higher values obtained. According to Figure 4, for higher wind speed from 1 meter per second (for wind comes from the front), drift increases and the coefficient of variation is more (CV= 29.03%). According to these results, it can be safe threshold wind speeds of up to 1 meter per second considered (Gil et al., 2015).

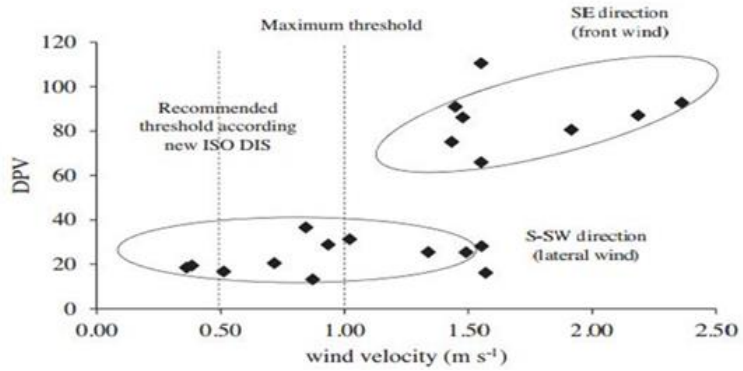

Figure 4. The relationship between wind speed and the DRIFT for 20 tests

Heidary et al (2014) in a study showing that With increasing wind speed, the drift rang increases for the flat fan nozzles (FF 11002 Albuz Axi), air induction flat fan nozzles (Albuz CVI) and Twin Jet Air Induction nozzles (Albuz CVI Twin), that this increases for flat fan nozzles is higher than the other nozzles, according to figures 5, 6, 7 and tables 1, 2 and 3:

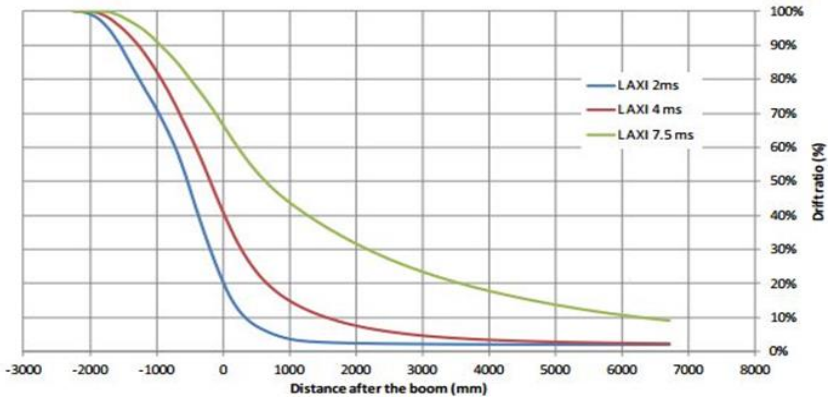

Figure 5 - Effect of wind speed on the flat fan nozzles drift

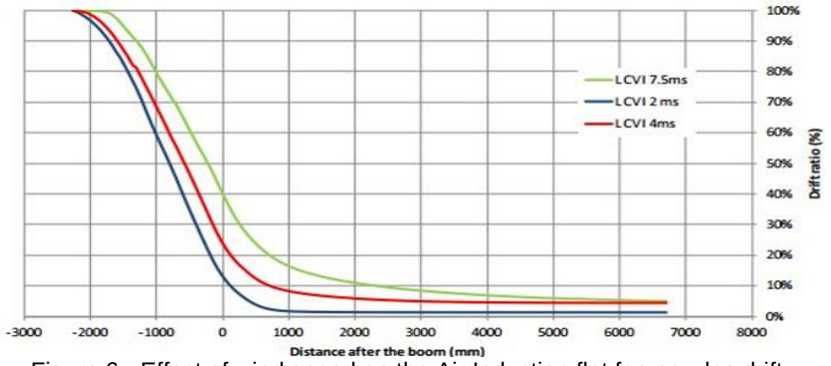

Figure 6 - Effect of wind speed on the Air Induction flat fan nozzles drift

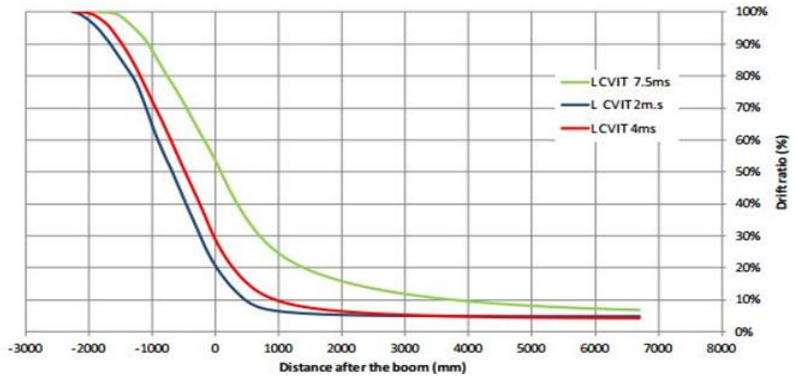

Figure 7 - Effect of wind speed on the Twin Jet Air Induction flat fan nozzles drift

Table 1. The DRIFT for AXI (flat fan) nozzles

Wind speed(m/s)	Drift range(%)	
	2m distance	5m distance
2	2	2
4	8	3
7.5	31	14

Table 2. The DRIFT for CV nozzles

Wind speed(m/s)	Drift range (%)	
	2m distance	5m distance
2	1	1
4	5	4
7.5	11	5

Table 3. The DRIFT for CVI TWIN nozzles

Wind speed(m/s)	Drift range (%)	
	2m distance	5m distance
2	5	4
4	6	5
7.5	16	9

Hassen et al (2014) studied the effect of wind speed on the drift range. As a result, the drift minimum in wind speed of 1 meter per second occurs at a rate of 5.004 percent, according to the table 4:

Table 4. drift range in the wind speeds

Wind speed (m/s)	Drift range (%)
1	5.004
2	16.084
3	27.463

The effect of temperature on the drift

According to the results Balsari et al (2007) With increasing the temperature from 10 to 25 ° C. decreased the drift potential values for T-Jet flat fan nozzles (Teejet XR11003) and T-jet air induction nozzles (TeejetAI11003), 50% and 70% respectively. But Nuyttens et al (2006) concluded that drift rate is reduced with temperature increase. This fact that the temperatures increase, the rate of evaporation increases, But for a fixed relative humidity, the lower temperature, resulting the higher drift. For example at a distance of 0.5 meters, By reducing the temperature from 15 ° C to 10 ° C. the rate of drift increased from 16.8 to 20.7 percentage, according Figure 8:

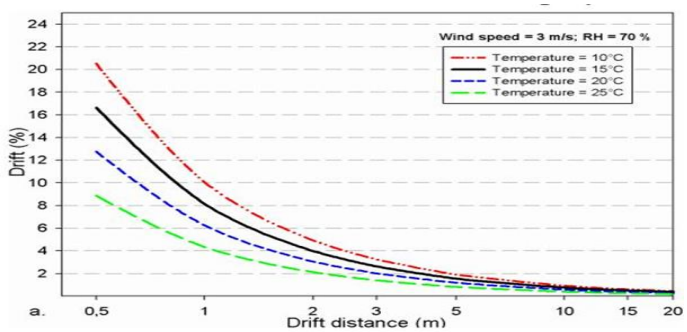

Figure 8. Effect of different temperatures on the drift

The effect of relative humidity on the drift

Nuyttens et al (2006) concluded by investigating the climatic conditions on the drift that the higher of relative humidity, reduces the amount of drift, for examples, at a distance of 0.5 meters, by reducing the humidity from 70% to 50%, drift increased from 16.7 percent to 24 percent, according to Figure 9:

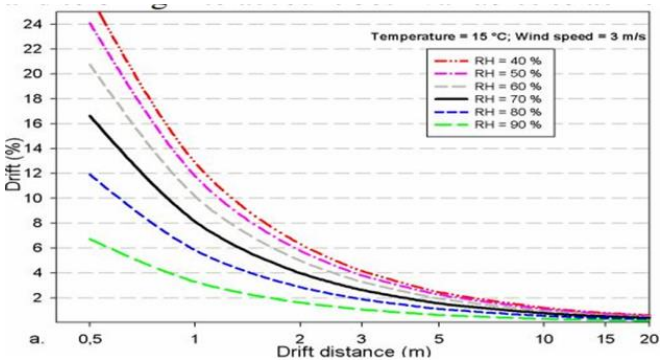

Figure 9. Effect of relative humidity on the drift

CONCLUSION

Drift is the particles do not remain on target. Drift is a major threat for the environment, Because most pesticides are toxic and a large part of pesticide poisoning caused by toxins drift. Because toxins today are stronger than they were before and very low quantities drift Leading to damage to the non-target plants and animals, drift In the recent years have been a very serious environmental concerns. By research on factors affecting at the drift such as climate conditions, the guidelines can be suggested in the any situation that this given the correct use of equipment for drift control. The guidelines such as using the nozzles with less drift, Sprayer Using with minimum drift, work at moderate weather conditions and according to the weather forecasts.

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